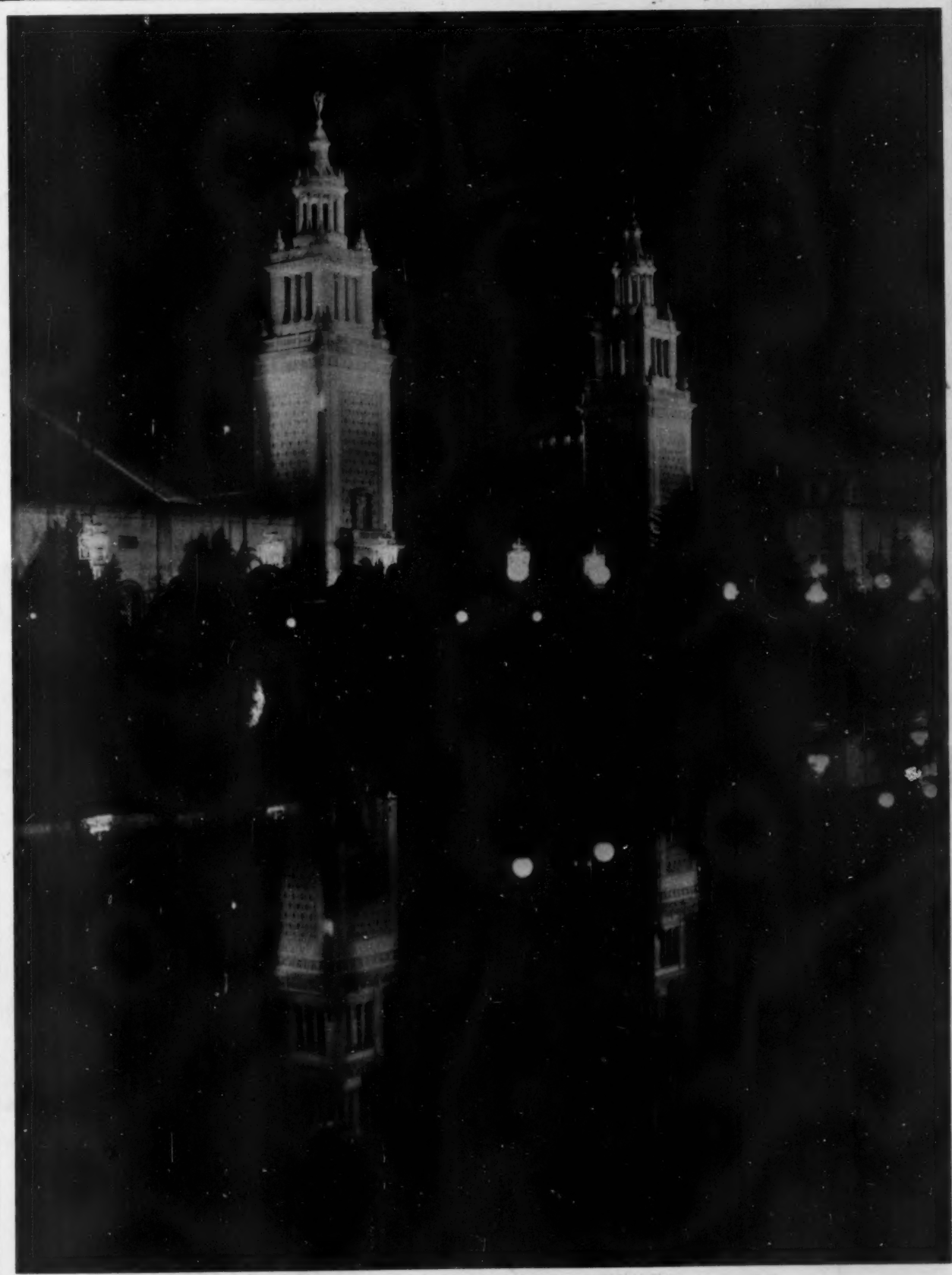
SCIENTIFIC AMERICAN



VENETIAN TOWERS AT THE PANAMA-PACIFIC EXPOSITION AT NIGHT.—[See page 378.

Vol. CXII. No. 17
April 24, 1915

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents
$3.00 A Year

Inner Tubes That Outlast Tires

Goodyear Laminated Tubes

We have built an Inner Tube—laminated and extra-thick—which outlasts any tire. Four Tubes outwear five Casings, on the average.

This year we have made them **still thicker.** To our smaller sizes we have added 12½ per cent. To our larger sizes, 16⅔ per cent of unadulterated rubber.

Yet, despite this increased weight—averaging 14 per cent—our prices are **one-fifth less.** On February 1st we reduced them 20 per cent. So these heavy Laminated Tubes now cost about the same as others.

Built Layer on Layer

Goodyear Laminated Tubes are built layer on layer.

Tubes built by machines, of one thick piece of rubber, often have undiscovered flaws. We roll the rubber into sheets so thin that flaws can be seen and discarded. Then those sheets wrapped layer on layer, are vulcanized into a solid rubber tube.

The valve patch—usually stuck on—is made an integral part of our Tube. No loosening here, no leakage.

This extra thickness, this pure rubber material, this layer construction and this leak-proof valve patch, make the Goodyear Laminated the greatest Inner Tube built.

Get This Extra Value

Lesser Tubes cost about the same as these do. In justice to yourself, get this extra value. Then remember that Goodyear Fortified Tires embody the same standards. They, too, excel all others—in five costly, exclusive ways. Any dealer will supply Goodyear Tubes or Tires.

GOODYEAR
AKRON, OHIO
Laminated Tubes
Extra Heavy Tubes—Uncolored
Built Layer on Layer
By the Makers of Fortified Tires

They Are Gray

Goodyear Tubes are gray, the natural rubber color. Any other color requires mineral adulteration. Minerals absorb heat, the greatest foe of rubber. We cannot color without making short-lived tubes.

This is a section of both Tube and Tire. The Inner Tube is pictured to show the layers which compose it. In completed Tubes these layers, of course, are vulcanized together into one solid rubber Tube.

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO
(2118)

FORD OWNERS

Do you know that—

sooty spark plugs at frequent intervals warn you to investigate your lubricating oil?

If your oil is either too heavy or too light in *body* it will accumulate in the combustion chambers. In burning-up it usually fouls the spark plugs with carbon.

Ford owners who use Gargoyle Mobiloil "E" make the best provision against this common cause of faulty ignition. The correct *body* of Gargoyle Mobiloil "E" prevents its working by the piston rings into the combustion chambers.

Do you know that—

incorrect *body* in your oil also leads to excessive carbon deposit on the piston heads and valve seats?

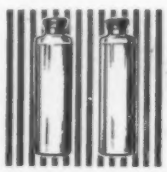
It is, of course, impossible to produce a petroleum-oil which will leave *no* carbon in burning. But the slight carbon of Gargoyle Mobiloil "E" rarely accumulates. It is of a light, non-adhesive character and expels naturally through the exhaust.

Do you know that—

oil of incorrect *body* fails to maintain a proper oil seal between the piston rings and cylinder walls? Part of the explosion and compression then escapes down past the piston rings. Weakened power results. Gargoyle Mobiloil "E," having the correct *body* for Ford motors, maintains the proper oil seal around the piston rings.

Do you know that—

while "light" oils are recommended by your Instruction Book there is a great difference between oils classed as "light" both in *body* and *quality?*



Many "light bodied" oils have no real place in *any* automobile motor. They vaporize rapidly in use. The oil then consumes far too quickly for proper protection to the metal surfaces. Maintenance cost mounts up. The noises of loose, worn parts follow.

In widespread daily use, Gargoyle Mobiloil "E" has shown remarkable ability to readily reach and protect all moving parts of the Ford motor and to maintain *a proper oil cushion under the heat of service.*

Ford owners who use Gargoyle Mobiloil "E" are providing the best of insurance against costly maintenance and motor repair bills.

In buying Gargoyle Mobiloils from your dealer, it is safest to purchase in original packages. Look for the red Gargoyle on the container. For information, kindly address any inquiry to our nearest office.

GARGOYLE

Mobiloils

A grade for each type of motor

VACUUM OIL COMPANY, Rochester, N. Y., U. S. A.

Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world.

DOMESTIC BRANCHES: Detroit, Boston, New York, Chicago, Philadelphia, Indianapolis, Minneapolis, Pittsburgh

SEVENTY-FIRST YEAR

SCIENTIFIC AMERICAN

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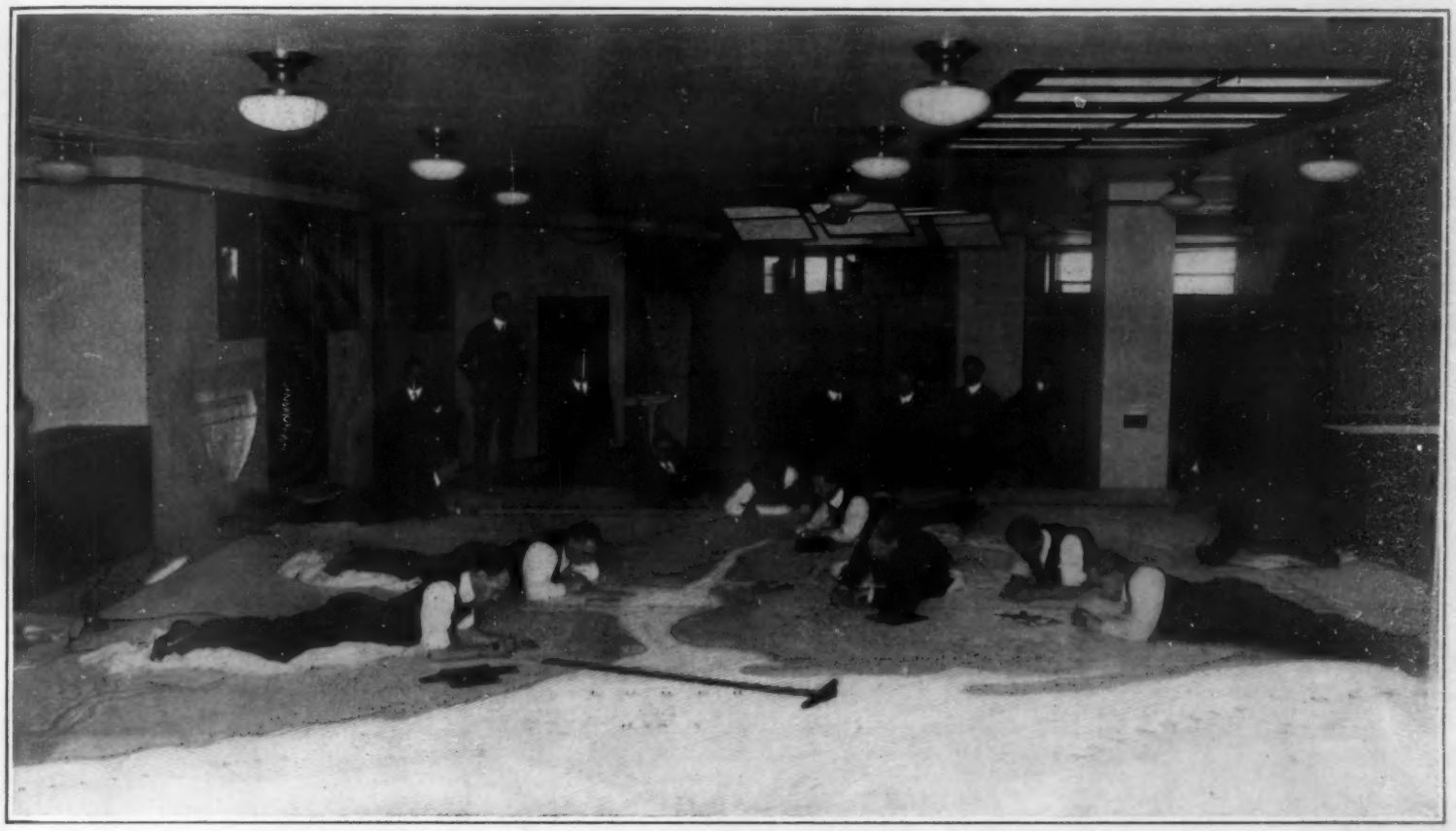

Piecing together the big map of New York city. Note the felt slippers and sheets used by the draftsmen.

New York City's Twenty-five Foot Map

By Charles W. Person

A GREAT map twenty-five feet wide, representing every street, park, harbor, island, lake, county and State line, railroad and steamship pier, and every topographical detail of Greater New York, has just been finished. One look at the new map is enough to convince you that 326.83 square miles is quite an area to represent on paper, especially when that area is one vast network of streets, parks, waterways, islands, and piers. By exact measurement the map is 25 feet wide and 25¾ feet long. The scale is 1 inch to 600 feet, which means that close to 1,200 square miles is included. Staten Island extends so far to the southwest that a large piece of New Jersey and many square miles of water have to be included in this map if it is to be put on a rectangular sheet. A reproduction of this map is being made on the scale of 1 inch to 1,000 feet, while another, on the scale of 1 inch to 2,000 feet, will be sent to the San Francisco Exposition. New Yorkers who wouldn't look at it at home may be interested in it out there.

It was three years ago that Nelson P. Lewis, chief engineer of the Board of Estimate, undertook to have a new map of the city made. There were official maps on hand at the time, such as the map prepared by the original Commissioners of New York in 1807, the Brooklyn village maps of 1819 and 1839, and the surveys of Kings County made in 1876, and, of course, there were innumerable maps privately printed. But what Mr. Lewis set out to do was to make a perfect map of the greater city which infringed no copyright. He gathered his material from the Borough Presidents, who have charge of the topographical records of their districts; from the Department of Docks and Ferries, and from the Street Cleaning Department. He obtained assistance from the States of New York and New Jersey and the United States Government. The railroad companies helped him with stations, routes, etc. All this information was assembled under the direction of the chief draftsman.

The first work of the draftsmen was to divide the city into sections and make preliminary maps of each section. After these had been tested and proven they were transferred to the final map. Here was where accuracy was put to a real test. It was found that the use of a pantograph would be too long and expensive, and photography, because of astigmatism of lenses, was not to be trusted. Thus it was that the chief draftsman, James A. Faust, rigged up tables each big enough to hold a section of the map, fitted glass to the top of each table, and placed four lamps of 70-watt power below the glass.

The preliminary map was put on top of the table and the anvil paper of the final map was laid on top of it. The light shining from beneath was so powerful that tracing was easy. Tracing cloth was not used at all, for the reason that it is so greatly affected by the weather.

It was discovered long before this tracing work was begun that the final map would be too big to be made and kept in one piece. There wasn't a room in the Municipal Building large enough to hold it. There was just one room, however, where the draftsmen had space enough to build a platform 28 feet square to hold the twenty-one sections which, when joined together, form the great map.

When the sections were completed there was the interesting task of assembling them and fitting them together perfectly. It was then that the city had to buy eighteen pairs of soft, felt slippers and white sheets for the men. A man would creep out on the map in his soft, clean slippers, to his particular section, spread a sheet before him, lie down on it, and then see if the north end of Brooklyn fitted exactly to the south end of Long Island City. It was nervous work, this shifting about on the big map, when a dig of the elbow might have obliterated work that would take hours to replace, or a quick turn might have overturned a bottle of ink.

There were some parts of Manhattan where it required nine hours' work to complete a section two inches square, and the draftsman who executed the large and handsome title in the northwest corner did nothing else but work on that title from nine in the morning to ten-thirty at night for a period of six months.

Scholarship for Belgian Students in American Universities

A MOVEMENT is on foot to assist in bringing to America worthy, intellectual men and women for a temporary free enjoyment of the privileges of American institutions. Assurances have already been received from the George Washington University for the instruction of ten students in any of the departments of the University, free tuition to the extent of $1,500 being furnished to European college students who are not able to pursue their courses owing to present conditions. It is estimated that between $20,000 and $25,000 will be required to defray the traveling expenses from and to Belgium and the cost of residence in Washington for a period of one year. The Belgian Scholarship Committee, which is a sub-commitee of the Central Committee for the Belgian Relief Fund, is endeavoring to raise this amount. Checks should be drawn payable to the Belgian Scholarship Committee, John Joy Edson, treasurer, Washington Loan and Trust Building, Washington, D. C.

Substitute for Wood in Pattern-making

A COMPOSITION that has many advantages over wood for making small patterns can be made as follows: With hot water mix into a thick paste three parts by volume of starch, one part ground glue, two parts fine resinous sawdust. The sawdust should not be added until the starch and glue have been dissolved by the water. After the ingredients are thoroughly mixed, heat the whole to 190 deg. Fahr. and continue the heating until the whole becomes a hard mass, then allow to cool and remove from the receptacle. The resulting composition is a strong, hard, horn-like substance that can be machined, sandpapered, and varnished the same as wood.

The principal advantages of this composition over wood lie in the fact that it has no grain, and therefore turned and complicated patterns made from it do not have to be built up or glued together, and that for the same reason it is easier to turn and machine, and offers a smoother surface when finished. It is also more fireproof than wood and not so readily affected by atmospheric changes.

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Munn & Co., Inc., 233 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp* the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Blockade by Submarine

WE deferred any editorial discussion of the so-called submarine blockade of the British Isles until the experiment had been under trial for a sufficient time to prove whether or no it is entitled to be called a blockade or should be designated by some other name less euphemistic.

The attempted blockade has now been carried on for sufficient time to prove that, so far as the submarine effort coming within the universally accepted definition of a blockade is concerned, it has been a complete fiasco.

A blockade, in the sense that has been established in the past history of the world, and in the present accepted meaning of that term, consists in establishing a cordon of ships around the sea approaches to an enemy's coast, so strong and effective as to prevent the passage of merchant ships to or from that country, carrying certain articles of commerce which are known as contraband of war.

Have the German submarines done this? The answer to that question is found in the statistics of British maritime commerce, which show that during the period in which this German experiment has been tried, only 2 or 3 per cent of the shipping which has entered or cleared from the British Isles has been intercepted and sunk.

Not only does this raiding of merchant shipping fail utterly to achieve the results which alone would entitle it to be dignified by the name of blockade, but it is also debarred from the use of that title by the fact that, in their method of carrying out the raid, the German Admiralty are deliberately violating those humanitarian laws which have been adopted for the purpose of mitigating the horrors of war, so far as they affect non-combatants.

In previous wars it has been the universal practice, when an enemy's ship which was carrying contraband was intercepted by the blockading vessels, either to take the vessel into port and confiscate her cargo, or, if this were impossible, to remove her crew and passengers and sink the ship upon the high seas. Always, care has been taken to safeguard the lives and persons of the non-combatants.

Now a submarine, in the very nature of things, being able to afford accommodations only for her crew, is unable to take aboard the non-combatants from the captured ships. Also, because of the risk to herself from enemy warships, she will rarely be in a position to take the ship into port. Because of the risk of detection, it will be impossible to make the usual examination of the ship's cargo, at the time she is held up, to determine whether there is contraband aboard.

These being the conditions, it follows that when the German Admiralty determined to institute this system of sinking any ship encountered in the so-called "war zone" they deliberately threw overboard all humanitarian considerations, and put themselves to that extent outside the pale of modern civilization.

No amount of labored casuistry can relieve them from this fearful responsibility. The question of their moral accountability stands or falls quite independently of anything which the Allies may themselves be doing. There is a sound old adage which says that two blacks never made a white. Germany has developed some very remarkable cases of moral self-delusion during the present war, and certainly the most conspicuous instance of this is her attempt to justify this practice of sinking all shipping in the enemy's waters on sight, without first determining whether it is carrying contraband of war or not, and without making any provisions whatsoever for saving the lives of non-combatants. It is mere casuistry to state that this practice is justified by the fact that the Allies are preventing foodstuffs from reaching Germany. The Allies are not sinking ships on sight; on the contrary, they are capturing them and taking them to port, or, if they should sink them, they are making every provision to save the lives of non-combatant passengers and crew. The cases are not in the least sense parallel and nowhere is this better understood than by the German Admiralty itself.

If the German submarines are to become effective in striking a vital blow during the present war, why does not the Admiralty send them out to sink the great British transports which come and go, apparently with impunity, between Great Britain and France? If the German submarine flotillas directed their activities against these ships, they would be keeping well within the sphere of legitimate warfare, and they would be striking a badly-needed blow for the relief of the hard-fighting armies of Germany in the western theater of war.

The War of Attrition

IN any discussion, anterior to the war, of possible conflict between Germany and Great Britain, the numerical superiority of the British fleet was accepted and great stress was laid upon the preliminary war of attrition, by which the margin of superiority of the British fleet was to be so worn down as to render it possible for the German main fleet to accept battle with an even chance of victory.

In accordance with this expectation, or policy, Germany paid particular attention to the development of what might be called the minor units of her fleet. Thus she built up her destroyer flotillas to a high standard both in numbers and efficiency; and it is notorious that the careful selection of officers for the command of her destroyers and the nature of the maneuvers in which they were constantly engaged, had brought this arm of the service up to a point of efficiency which was not surpassed in any other navy.

In the earlier years of its development, Germany looked askance at the submarine; and, for once, the astuteness of the Germans in recognizing any invention which had shown promise of practical development, seems to have failed them. For it is a fact that Germany entered the field of submarine construction rather late in the day; though it must be admitted that, having once taken hold of the problem, she has developed vessels of this class which are as good and, probably, because of Germany's excellent work in the field of oil motors, a little better than those of other countries.

Consistently with her policy, Germany from the outset of the war, concealing her main fleet behind the mine fields guarding her harbors, has sought to carry into effect her policy of attrition. And it must be admitted that she started out very well indeed, for the sinking of the three large armored cruisers, "Cressy," "Aboukir," and Hogue," in the early months of the year seemed to foretell a steady diminution of the strength of the enemy—a forecast which was subsequently substantiated by the loss of the pre-dreadnought "Formidable" and, possibly, of the dreadnought "Audacious."

The subsequent actions in which it came to be engaged, however, have shown the destroyer fleet of Germany to be shorn of its terrors; for these craft have fared badly at the hands of the enemy, and, so far as it has been officially announced, they have not, thus far, accounted for a single ship of importance. It is chiefly the mine and the submarine that have been responsible for such diminution of the forces of the enemy as has occurred.

After nine months of war, so far from Great Britain having lost any of her numerical superiority, her gains have greatly exceeded her losses, and she is much stronger to-day than when the war started. Her main fleet has been increased by the addition of several ships of the "Queen Elizabeth" class, any one of which, in a rating of its fighting value, would more than offset the total naval losses of Great Britain since the war began. According to the reports of the First Sea Lord, the strength of the main fleet of the British navy is growing at the rate of a dreadnought per month—a statement which seems to be borne out by a study of the naval programme and by the speed of construction in the government and private yards of Great Britain at the time when war was declared.

Furthermore, it is a question whether the attrition has not been as great on the side of Germany as on that of Great Britain. The fine armored cruiser "Blucher" may fairly well be set off in value against the old battleship "Formidable," and surely the "Scharnhorst" and "Gneisenau" represented a greater fighting value than the three old armored cruisers "Cressy," "Aboukir," and "Hogue." True, there is the "Audacious"; but it must be admitted that there is at least a reasonable doubt as to whether that ship, badly hurt as she was, really went to the bottom.

Furthermore, in addition to the three German armored cruisers above mentioned, there are two older vessels of this class that have been lost, the "Yorck" and "Friedrich Karl." To these must be added the light cruisers, "Magdeburg," "Köln," "Mainz," "Emden," "Dresden," "Nurnberg," "Königsberg," and "Leipzig," all of them among the best of their class afloat.

The loss in ships is equalled by the loss in men, and a naval writer in the *Naval and Military Record*, basing his estimate of the complement of these ships, as contained in the German publication *Nauticus*, arrives at a total estimate of 8,550 men in the ships which have already been lost. A certain proportion of these officers and men was saved, but it is fairly certain that the losses represent over 10 per cent of the total *personnel* in the German navy.

Rational Research

THE small fraction of mankind which controls the destinies of the whole is fully aware of the advantages that spring from increasing knowledge. These advantages have been attested by centuries of experience, so that the quest of truth is no longer mere obedience to a primordial instinct, but a deliberate and reasoned attempt to ameliorate the human lot, physically as well as intellectually. Yet not only is the amount of human energy devoted to the increase of knowledge insignificant in comparison to that expended on other objects—as, for example, the conservation of knowledge that is doubtfully worth conserving—but the customary methods of acquiring fresh information are flagrantly uneconomical, because utterly devoid of system.

The Carnegie Institution of Washington is the most prolific research agency extant. Its importance, however, as a factor in human progress is by no means to be measured merely by its direct contributions to knowledge. This institution—or, properly speaking, its sagacious director—has made the capital discovery that the most serious problem with which such an agency has to deal is not one of physics, or astronomy, or biology, or the like, but rather of what, in the absence of any more familiar name, we shall call "heuristics." In other words, such an establishment is called upon, first and foremost, to ascertain the most effective methods of applying its resources to the promotion of research, and this problem is a far more difficult one than might appear at first sight.

The fallacies that have hitherto prevailed as to the functions of research institutions in general, and of the munificently endowed Carnegie Institution in particular, were set forth last summer by Director Woodward in an address which has evoked many echoes at home and abroad. This eloquent address, delivered at the dedication of the Woods Hole Marine Biological Laboratory, was perhaps the first complete formulation or crystallization of ideas developed in the course of the speaker's experience at the head of the Carnegie Institution, and some of these ideas are further developed and reinforced in the latest yearbook of the Institution, just published.

Dr. Woodward refers to "the widely spread, if not prevalent, assumption that research establishments are mere disbursing agencies, waiting for suggestions of appropriate ways in which to apply funds." Such has, indeed, been the prevalent assumption, not only among laymen, but also among men of science. In contrast to this doctrine is the one to which the Carnegie Institution is now unreservedly committed, viz., that "it should be the primary purpose of a research institution *to institute and to conduct research*."

To quote again: "Another popular illusion is that research establishments should busy themselves in casting drag-nets in the wide world of thought, or dredging, as biologists would say, with the expectation that out of the vast slimy miscellanies thus collected there will be found by the aid of a corps of patient examiners some precious sediments of truth"; and this despite the recognized fact that "the doors are thus opened to the hosts of amateurs, dilettanti, and paradoxers who stand ready to waste the time and the resources of research establishments in the pursuit of the obvious, the futile, and the demonstrably unattainable" (to say nothing of downright quacks and charlatans).

The Carnegie Institution has fully satisfied itself that this "drag-net" method, still highly favored by many persons of intelligence, is about the most wasteful way in which such an institution can employ its time and money.

It can hardly be doubted that the Carnegie Institution, in limiting its grants to persons whose fitness for research undertakings has been most rigorously demonstrated; in devoting the major part of its resources to certain large problems, the investigation of which is entrusted to corps of permanently employed experts; and especially in inaugurating lines of work of its own motion, has set an example that will hereafter be widely followed.

Science

Camphor in the Philippines.—It is reported that Blumea balsamifera which grows wild in abundance in the Philippines, has been found to be identical with the plant from which *ngai* camphor is obtained in certain parts of China. The commercial possibilities of this plant are now being investigated by the Philippine Bureau of Science and Bureau of Forestry.

The Kuskokwim River, the second largest river in Alaska, is about to be opened to commerce in consequence of the discovery, by Capt. Lukens of the Coast and Geodetic Survey, of a navigable channel in its extensive and hitherto little known delta. The river itself is navigable for a distance of 600 miles from its mouth, and is thus destined to make accessible a very promising mining, fishing and agricultural region.

A School of Forestry in China.—It is notorious that afforestation is one of the most urgent of China's needs, and it is therefore of interest to learn that a school of forestry is about to be established in the University of Nanking. The co-operation of the director of forestry at Manila has been secured, and it is proposed to send two experts from Manila to aid in establishing the school.

Climate and Efficiency.—It is estimated by the Los Angeles Chamber of Commerce that labor is twenty per cent more efficient in and about the Southern California metropolis than in eastern cities, where extreme temperatures affect a man's working capacity. Holding that climate is one of the most far-reaching of all factors which influence industrial progression, the Chamber officials state, in a recent bulletin:

"It affects labor efficiency, it regulates the comfort and the cost of living, it influences the cost of building construction, it controls manufacturing possibilities, it determines the number of possible operating days within a year and it governs the cost of production. Figuring on a basis of 20 per cent added labor efficiency, Los Angeles' climate would increase the actual labor assets of Pittsburgh more than $300,000,000 per year. This is because of the almost entire absence of humidity, oppressive heat and extreme cold."

Tinned Cheese.—In this age of "sanitary" packages for food products, it is an anomaly that we still buy our cheese by the pound, sliced off from a common loaf at the grocers. For a number of years the U. S. Department of Agriculture has been testing the merits of cheese put up in air-tight tins, and the results are said to be satisfactory. It is found commercially practicable to press cheese of the Cheddar type in hoops of small diameter, cut it into pieces of the desired weight, and seal it in the tins. This process not only conduces to the preservation of the product, but also prevents loss by evaporation and the waste entailed in cutting. Moreover, the tinned cheese has no rind, and this fact represents a gain which helps to offset the cost of tinning, estimated at about 3 cents for labor and tins.

The Psychology of Practice.—The question of short *versus* long periods of practice in training the human muscles for any particular kind of work is obviously one having far-reaching application. Some interesting experiments on this subject have been carried out by Dr. K. S. Lashley, of John Hopkins University. Acquisition of skill in archery was selected as the subject of observation. Twenty untrained persons were divided into three groups. One group shot 5 arrows with the English longbow per day; another, 20 shots per day; and the third, 40 shots. The results showed conclusively that the group shooting only 5 times a day improved in accuracy with less expenditure of time in practice than was required by either of the other groups for the same amount of improvement. A report on the experiments says: "The relatively greater efficiency of short periods of practice continuing for many days is in accordance with the results of the study of animals and of speech habits in man, and indicates that in training to muscular feats, in both animals and men, the *length of practice periods required is usually too great for maximum efficiency.*"

The Study of Atmospheric Electricity which has been generally neglected in this country, is destined hereafter to form a prominent feature of the work of the Carnegie Institution's Department of Terrestrial Magnetism. The last annual report of the directors calls attention to the important articles by which Dr. Swann published during the past year in *Terrestrial Magnetism*, which have brought out new points in the theory of this subject and also led to notable improvements in apparatus and methods of measurements. The Department now announces that its work in this field is to be expanded in two directions; viz., (1) continuous observations, by self-registering instruments, in atmospheric electricity and radio-activity, both at the laboratory in Washington and at such observatories elsewhere as it may be found possible to establish; and (2) a general electric survey of the globe, implying observations at points distributed over the earth's surface, somewhat as in a magnetic survey. The latter undertaking has often been suggested in the past, and is undoubtedly an urgent desideratum, assuming that there is now general agreement as to the proper methods of observations.

Automobile

A Novel Tire Repair Stud.—Hugh Taylor Stephens, of Carmarthen, Wales, in a patent No. 1,131,745, shows a small puncture mending device having a stem to extend through the tire, a disk at one end of the stem and an inverted cup at the other end of the stem, and adapted to be pressed down to clamp the tire against the end disk.

Novel Pocket Screwdriver.—Motorists are sometimes in need of a screwdriver for instant use, and hate to stop the car, dig into the tool box for the big screwdriver and waste five or ten minutes in the operation. For these there has been invented the "Pocket Screwdriver" which is really nothing but a circular piece of steel, the size of a quarter, tapered along the rim, so as to "take" any size or type of screw.

Differential Locks for War Trucks.—One of the lessons learned during the present war has been that of having either a four-wheel drive truck or a differential lock. When one of the rear wheels becomes mired in soft ground, it behooves the driver to lock the differential immediately, in order to get the truck out of the mud. Several good trucks have been lost because of the driver's inability to get the wheels to grip the ground.

Damages for a Broken Footboard, $10,000.—A most unusual case has just been decided in Buffalo, N. Y., in favor of a little girl who, in jumping over the back seat of her father's automobile broke through the footboards, entangling her right leg in the machinery. The leg had to be amputated. After listening to the testimony of manufacturers and carpenters, the jury decided that the maker of the automobile was responsible for the accident and awarded the girl $10,000 damages. The case has been pending since 1909.

Where the Slowest Lead.—When motor trucks loaded with ammunition are despatched to the front, from a depot in the rear of the firing lines, it is now self-understood that the slowest trucks go in front, while the fastest bring up the rear. This was found necessary because of the tendency of ammunition drivers to go at top speed, when the call for shells and cartridges comes. If the slow trucks are in the rear of the column, the latter is strung out over miles of road, with great gaps between trucks—offering an inviting target for an attack by reconnoitering armored motor cars or cavalry.

London Buses Are Still Running.—According to the figures issued by the London traffic police, there were at the end of March 2,029 motor omnibuses again in service in Great Britain's capital. It is stated that more and more buses are withdrawn from the continent for regular service in the city, and new trucks are being installed for the military services of the country. The withdrawal of the buses from passenger traffic in the first two weeks of August was caused by the general unpreparedness of the British transportation service. This unpreparedness, it is announced, is now overcome.

British Suggest 12-Cylinder Motor Car.—While a 12-cylinder motor car is not exactly a novelty in Great Britain, the Sunbeam having appeared several years ago in this type, the latest suggestion among British motor car manufacturers as to 12-cylinder machines is worthy of special comment. It is nothing more or less than the fixing of the 12 cylinders in "arrowhead" form, that is to say with four cylinders standing vertical, and the others in two four sets at an angle of 45 degrees on either side of the vertical set. Such a motor would be exceedingly short and compact, requiring, despite its large number of cylinders, only a short hood.

Less Crude Rubber this Year.—Careful estimate of the quantity of sap collected so far from the rubber trees in South America, Africa and the East Indian plantations shows that there will be less crude rubber in 1915 than there was in 1914. The shortage may prove very serious at the beginning of next year, as the indications point to still smaller quantities in 1916. The crude rubber crop of 1914 amounted to 71,977 tons of plantation; 37,000 tons of Brazil, and 12,000 tons of miscellaneous caoutchouc—a total of 120,977 tons, representing an increase of 11.5 per cent over the 1913 crop. The figures for 1915 are given as (approximately): 85,000 plantation, 30,000 Brazil and 5,000 miscellaneous rubber, a total of 120,000 tons, or a decrease of almost 1 per cent.

A Sectional Inner Tube.—In an endeavor to solve the puncture problem, a New York inventor has brought out a sectional pneumatic tube—an idea which has occurred to more than one inventor. The tube consists of fifteen sections, each in itself a complete inner tube, not unlike a string of sausages. Each section is connected with the main valve, by a metal tube, within the rim. When a puncture occurs, the space formerly occupied by the punctured section is at once taken up by the two adjoining sections, which expand and maintain the air pressure in the tire. Tire experts who have examined the tube, are of the impression that if two adjoining sections should be punctured before the tire is renewed, the side pressure from the adjoining sections, in trying to fill up the vacant space, would be so strong as to tear out the valves of these sections.

Notes for Inventors

Extinguishing Automobile Fires.—James B. Erwin and Orlando R. Erwin of Milwaukee, Wis., in patent No. 1,130,719 present a fire extinguishing process in which if a fire occurs in an automobile hood it will release a fire extinguishing liquid which will be discharged on the preheated motor surfaces and vaporized to fill the hood with a fire extinguishing gas.

Sleeping Car Ventilation.—The lower berth in a sleeping car is stuffy with the windows closed and if you open the window the cold air is directly on you. It is thought that the riding public would appreciate some deflector or diffusing construction which could be applied to the open window over the usual short hinged screen and permit the entry of fresh air, at the same time preventing it from blowing directly on the passenger in the berth.

Improving the Tone of a Talking Machine.—To eliminate the shrillness and deaden the metallic sounds of the talking-machine, a German inventor has just patented a principle of tone-protection that employs a lining of cocus-fiber for the cabinet, by which that is hermetically sealed, washers and other accessories of the same material for the phalanges of the tone-arm and all other points of metal contact and a fiber base for the record. He asserts that by this principle the surviving musical tone is immeasurably enhanced in quality.

New Electric Bell.—An original electric bell combination is in use at Paris which is designed to get rid of all trouble caused by the question of batteries, for these are now lodged within the apparatus itself. The usual box bell shape is retained, but the arrangement of the parts is different in this case. All the magnet parts are now lodged under the gong itself, while the box being now left free, serves to contain a set of three dry battery cells which will last for several years. In this way there are no connections to be made between the battery and bell, and the wires and push-button are the only pieces which need to be attended to.

Door Fastener.—Placing a wedge under a door is one of the most effectual means of closing it, for pushing upon the door from the outside only increases the effect of the wedge. A convenient device of this kind is made of metal, and it not only serves to wedge the door but also contains a mechanical bell mounted on the same base and behind the wedge in such way that pressure on the face of the wedge by the door causes the bell to ring. The base carries a set of short points underneath so that it can be put in place and grips upon the carpet or flooring so as not to slide out of position. Such a device can be carried in the pocket, and it is to be recommended for traveling.

Pocket Atomizer.—A recent novelty is a pocket atomizer in the shape of a watch. The head or top has a small orifice, and the spray is produced by pressing on the flexible metal sides. A miniature funnel is provided for the filling, which is done by unscrewing the head. Another atomizer consists of a small cylindrical pump mounted on a cork so as to fit into any bottle and thus avoid handling of the perfumes from one bottle to another. A plunger at the top serves to produce the spray from a side orifice. The tube which descends into the liquid has a second or telescoping end so that the tube can be extended down as far as the bottom of the bottle and thus take up all the liquid.

A Combined Swab with the Medicament.—In patent No. 1,131,575 to A. D. Tuttle of Washington, D. C., is provided a swab for surgical purposes formed of an absorbent material such as raw cotton provided with a suitable handle. Embedded in the swab is an easily broken glass bottle which contains the liquid it is desired to apply to the swab. The swab with the liquid can then be easily transported without danger of accidental breakage, and the container of glass can be readily broken when desired to permit the liquid to permeate the swab. The friable container is sealed and has no stopper and cannot waste its contents until intentionally broken. The swab will prevent the fragments of glass from causing any injury

Paper Cartridge Cases.—A new application of extreme interest at the present time of the metal sprinkling process invented by Mr. M. U. Schoop, an engineer of Zurich, consists in the manufacture of cartridge cases from metallized paper in lieu of brass or copper. The advantages of such a process are apparent even to the layman. A certain independence of the large quantities of brass and copper hitherto required is obtained. In addition to this, there is a saving in weight of three to four grammes in each cartridge, as a result of which the soldier can carry a considerably larger quantity of ammunition than heretofore. In the Schoop process the liquid metal is crushed by means of compressed air and is then inflated by any known method into extremely fine particles. Metallized cardboard or paper can in this way be provided with any durable and well adhering metal coverings of any desired thickness. For the purpose above mentioned very thin coatings of a few thousandth parts of a millimeter in thickness are of course sufficient.

The Court of the Four Seasons at the Panama-Pacific Exposition illuminated by a battery of forty-eight 36-inch searchlights on a jetty in the harbor.

The Panama-Pacific International Exposition at Night

How the Illuminating Engineers Uses Light Decoratively

By Hamilton M. Wright

TO the expert the lighting of the great exposition at San Francisco marks an epoch in the science of lighting and in the art of illumination. To the layman the illumination of the exposition is its most mystical and enthralling feature, and apart from its technical and scientific interest the illumination is a magnificent success. At night myriads of beams of light of changing colors cast a spell over the exhibit palaces at the Golden Gate.

The plan of illumination was undertaken with the idea of presenting the exposition at night in the same relative values of color and perspective in which it is observed by day. And the plan has worked out successfully. At night the architectural details of the exhibit palaces are intensified; the beauty of the sculpture is enhanced, and under the plan of diffused and projected light the more important details of the sculpture are emphasized. There are no black shadows to modify the intent of the sculptor, and the inspiring psychological effect produced upon the visitor by the vast fields of melting riotous colors under the brilliant California sun becomes intensified at night; the exposition becomes more resplendent.

The most conspicuous objective of the lighting plan is the lofty Tower of Jewels, 435 feet in height. This monumental sculptured pile when played upon by hundreds of concealed searchlights stands out like a vast terraced pyramid of ivory, almost satin white, with the minute details of its architecture limned against the dark heavens.

The result sought in the illumination was, as before suggested, to co-ordinate the artificial lighting with the colors of the exposition and with those provided by nature in the shrubbery and landscaping upon the exposition grounds (an object representing the highest artistic effort of which the illuminating engineer is capable), so that the coloring of the exhibit palaces, the rich shades of the mural paintings, and the ornamental details of the buildings would appear at night in the same relative values as by day. It was early decided to abandon the method of outline or silhouette lighting employed at other expositions and to use at the Panama-Pacific International Exposition only reflected light as the principal source of the illumination. The objection to outline lighting was two-fold: the great strings of electric lights formerly used to outline the contours of the exposition palaces cast black shadows, so that only a portion of the exposition was seen. Moreover, the dark shadows frequently obliterated the very features which the sculptor intended most to emphasize. The sculptor demands that his work shall not be impaired by the method of illumination, and this demand, too, is true of the architect and of the artist.

In the illumination of the Panama-Pacific International Exposition it was felt that the recent advances in illumination methods and materials had rendered practical a plan of illumination that would have been impossible at the last great exposition, at St. Louis, ten years ago. Moreover, the operation of batteries of searchlight projectors had developed to such an extent as to produce amazing pyrotechnic effects in variety, intensity and splendor exceeding and overwhelming any results achieved through the use of fireworks.

At the exposition the lighting is produced with a dramatic effect suggesting undreamed of power and potentiality. A resplendent aurora of colored light spreads far into the heavens from a giant scintillator placed on the harbor's edge before the exhibit palaces and it is visible at a distance of from fifty-to sixty miles.

Great shafts of light, quivering and changing, reach far into the heavens like tentacles of giant octopi. Numerous unexpected results are produced. Through the intersection of one shaft of light with another, for example, great rings suggesting those blown from a cigar are made to appear in the heavens.

Four principal methods of illumination are employed at San Francisco. Opposite the walls of the exhibit palaces are luminous art standards bearing heraldic shields which reflect light against the façades of the palaces. The shields are transparent, the sides nearest the palaces presenting a white surface which reflects the light against the buildings. The side of the shields farthest from the palaces is faced with a heraldic emblem on which is written the early history of the Pacific Ocean and of California and through which the light shines.

The second method of indirect illumination is found in the concealed batteries of searchlight projectors mounted upon the exhibit palaces and at other points of vantage. While the projectors themselves are not visible, their light directed against the monumental sculptures, towers and minarets, imbues these objects with radiancy. All of the principal architectural and sculptural works of the exposition stand out at night like giant transparencies, and even their minor details are clearly outlined.

The third source of lighting—although the order in which the sources are enumerated is purely one of convenience—is that of the concealed light which proceeds from the inner recesses of the columns which encircle the courts or are placed upon the lofty Tower of Jewels and on the two Italian towers, commanding the entrance to the Court of Palms and to the Court of Flowers. This method of lighting is also used in the vaults of the great archways and in other situations where it is desired to cast light upon the mural paintings. From afar one sees the Tower of Jewels radiant under the shafts of light case by the giant searchlights and a phosphorescent tinge as if the tower were itself a source of light is imparted through the rich Venetian glow of the lights placed inside the columns on the tower and not visible to the spectator. Thus, one beholding the tower, sees it limned against the heavens by the batteries of white searchlights, while the concealed lights on the inner recesses of its columns, suggesting a charcoal furnace, imbue the tower with the effect of transparency.

The visitor beholds this monument quivering with thousands of shaking prisms and seeming itself to emit light as though it were some giant pyramid of celluloid through whose transparent surface the red glow from within is revealed. The fourth source of light is that

(Concluded on page 389.)

Valuable Products Recovered from Coke Oven Gases

The Enormous By-product Coke Plant at Gary, Indiana

ENOUGH benzol to run 200,000 automobiles per year, and enough sulphate of ammonia to supply the farmers of this country with fertilizer for two years, at the present rate of consumption, was thrown away in the waste gases of the bee-hive coke ovens of the United States, in 1912. In addition to this, large quantities of tar, and even of the coke itself, were consumed by the extravagant process of the bee-hive oven. All together the value of the by-products had they been recovered would have been about $80,000,000. If the same amount of coal had been coked in retort ovens, over five million more tons of coke would have been obtained. It is estimated that about 6,800,000 tons of coal were absolutely destroyed.

Only in a land rich in natural resources is such prodigality tolerated. In Germany, where coal is mined at great depths under conditions that make the product more expensive, bee-hive ovens were abolished twenty years ago. All coke is produced in retort ovens, and in 1911, 80 per cent of these retort ovens were of the by-product recovery type. In the bee-hive type of oven a certain amount of air is admitted into the oven, which results in consuming not only the free gases of the coal, but also some of the coal itself; while in the retort type of oven no air is admitted, and consequently there is very little loss of fixed carbon, such loss as occurs being due to the presence of air in the oven when it is charged, and also the exposure of the incandescent coke to the air when it is discharged from the oven and before it is quenched.

We are now beginning to realize how wasteful is the bee-hive oven and how necessary it is for us to conserve our supplies of fuel. In 1911 about twenty-seven million tons were made in bee-hive ovens as against nearly eight million tons in by-product ovens. In 1912 eleven million tons of coke were produced by means of the by-product system, and in 1913 by-product coke amounted to 12.7 million tons. The figures for last year's output of by-product coke and the ratio to bee-hive coke have not yet been compiled. When plants now building are completed, nearly half of the coke made in Southern States will be produced in by-product ovens.

Bee-hive plants are usually located near the mines, while by-product plants are located usually at the point where the coke is used. In illustration of a typical by-product plant we publish herewith several photographs taken at the enormous coke plant of the United States Steel Corporation, at Gary, Ind. It is the largest by-product coke plant in the world, comprising 500 ovens. Here, 2,900,000 tons of coke are produced per year, all of which is used in the adjoining steel plant. A hundred and twenty million cubic feet of gas are recovered per twenty-four hours, which is much more than all the gas consumed in the city of Chicago. Half of the gas is used for heating the ovens, while the other half is used in the heating furnaces as well as in the open hearth furnaces of the steel plant. The ovens are arranged in two rows of four batteries each, and there are seventy ovens to a battery. The ovens are 32 feet long, and taper from a width of 17 inches at one end to 21 inches at the other, the purpose of this taper being to facilitate the discharge of the coke.

Briefly, the coking process is as follows: The coal is screened and then crushed until 90 per cent of it passes through a screen of ⅛-inch mesh. After this it is carried up to a mixer where the coals are combined in the proper proportions. Thence it goes to the storage bins. From the storage bins the finely crushed coal is carried in lorry cars which run on tracks over the ovens. The coal is dumped out of the car into the oven through charging holes at the top and is leveled off. Then the charging holes are sealed, and the coal is coked for from seventeen to twenty hours.

A longitudinal section of an oven chamber is shown in an accompanying drawing, which illustrates the regenerator, for utilizing the heat in the gases. Gas from the by-product plant comes through the mains *A*, running along the entire length of the battery of ovens at each side, and then passes through the riser pipe *B*, into gas distributing channels *C* of fire brick under the ovens. From the gas distributing channels, the gas enters passages *D*, between the ovens, where on coming in contact with heated air, it is ignited. The air enters the combustion chamber from the passageway *E*; then it goes through one of the two regenerators *F*, of checker brick, where it is heated to from 2,000 to 2,200 deg. Fahr. The burning gases flow up the flues *D* on one half of the length of the ovens and the products of combustion pass down the heating flues on the other half of the regenerator on that side, whence they are sucked out through the flues *G*, connecting with the chimney. The checker bricks in this second half of the regenerator extract the heat from the burnt gases and store it up. When the course of the gases is reversed fresh air passes through this second half of the regenerator and its temperature is raised by the heat stored therein, while the burnt gases now flow through and deliver heat to the first half of the regenerator. Every half hour, on the average, the course of the gases is reversed.

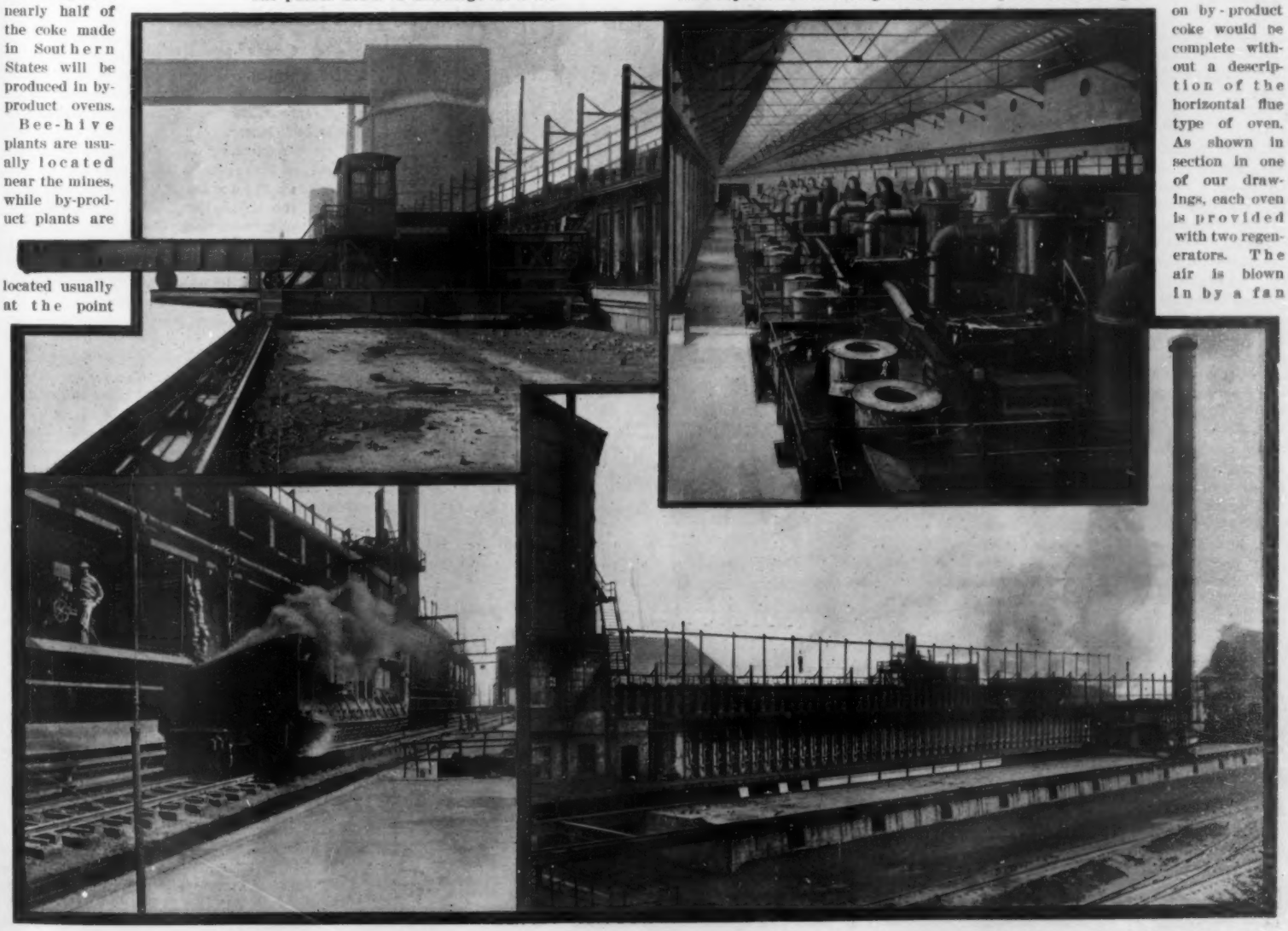
After about eighteen hours, when the coal has been thoroughly coked, a pushing machine moves to position at one end of the oven while a car, to receive the coke, is brought into place at the opposite end. Guides are placed each side of the discharge ends of the oven, and the doors are removed at each end of the oven by mechanical means. The ram, or pusher, then is brought into operation.

This consists of a long beam with a pusher head just fitting the doorway of the oven. This ram is operated to push the coke out of the oven and into the coke car. One of our photographs shows the pusher in operation, while immediately below may be seen the glowing coke forced out of the oven between the guides and tumbling into the car. As soon as an oven is discharged, the glowing coke is carried to a quencher where a shower of water drowns out the blaze, and cools the coke to a point where there is no further loss by combustion. As soon as the oven is discharged, the doors are replaced and sealed with fire clay and a fresh charge of coal is dumped into it.

It should be understood, of course, that this is by no means the only successful type of coke oven. We have chosen it for illustration because the largest plant is of this type. But no article on by-product coke would be complete without a description of the horizontal flue type of oven. As shown in section in one of our drawings, each oven is provided with two regenerators. The air is blown in by a fan

The pusher about to discharge an oven.

Acid separators recovering ammonium sulphate from the gas.



Flaming coke tumbling out of an oven into the car.

A battery of seventy coke ovens viewed from the pusher side.

through one of the regenerators and passes up through the flue system burning the gas which is supplied to each flue. The products of combustion pass out through the other generator. On turning a damper the flow for an entire battery of ovens is reversed, the air now flowing in, from the second regenerator, to the top and descending through the horizontal combustion flues.

Returning to the plant at Gary, the gases on leaving the oven pass on to the by-product plant, where they are first cooled with air and water from a temperature of 1,000 degrees to about 104 deg. Fahr. This results in precipitating most of the tar and ammonia. Thence the gas passes through a pre-heater, which raises its temperature to about 160 deg. Fahr., and is conducted to an acid saturator, in which the ammonia is extracted by contact with sulphuric acid and is recovered in the form of ammonium sulphate. The salt is removed from the saturator by means of an air ejector and is delivered upon a collecting table, whence it is run off with the mother liquor into a centrifugal dryer. From the saturator the gas passes through the acid separator and then returns through the mains to the oven. The tar recovered by this process is used to a small extent for fuel purposes in the steel plant, but most of it is sold for use in the manufacture of saturated felts and pitch for roofing, waterproofing and paving, and also for road construction, the extraction of tar products, etc. The ammonia liquor recovered by this process, after refining, is used largely for refrigerating purposes in the slaughter houses of Chicago, while the sulphate of ammonia is sold for use as a fertilizer, for which purpose it is in great demand. As it contains 20.5 per cent nitrogen, which is by far the most costly element of plant food, and the one of which most soils are in need, this by-product is of great importance to our agriculture. It is regarded as a standard carrier of nitrogen both in this country and abroad, and is applied by itself or as an ingredient of commercial fertilizer mixtures. It is also interesting to learn that the nitrogen which was stored up by the sunshine and vegetation of the remote coal ages, and buried for uncounted centuries, now returns to the cycle of life and growth to feed the crops of our latter-day earth.

At present the plant at Gary is not equipped with apparatus for recovering benzol. A number of by-product plants already have such apparatus, and it is proposed to install benzol-recovering apparatus at all the largest and newest by-product coke oven plants.

Contrary to the popular impression, benzol is not obtained from the tar, but from the coke oven gas. After the ammonia has been extracted the gas is scrubbed with a light oil which extracts the crude benzol. Then the benzol is obtained by distilling the oil in steam-heated stills. The oil may be used repeatedly.

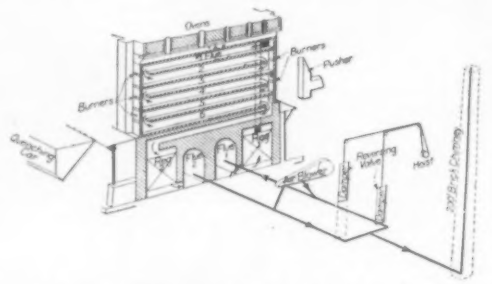
The Barometer and Health

EVERY person capable of putting two and two together and obtaining the correct answer has been conscious of feeling out of sorts, as the printer would say, when the clouds hung low and the sun was obscured. A week of dull weather sets a whole community on edge and the mental, moral, and physical components of man are, at its close, about fit for the scrap heap. Under such atmospheric conditions, when prolonged for a number of days, an Englishman admits that he feels "seedy" and the American confesses that he is feeling "mean," both adjectives relating to a state of mental and bodily dumps.

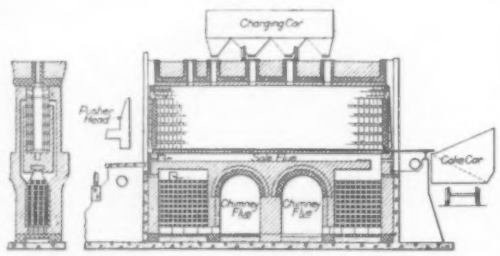
This situation is generally attributed to the lack of sunshine, for every human being retains the ancient beliefs in the potentiality of the sun in its relation to his life and its well-being. He knows that it gives warmth and light and brings forth his crops from the fruitful earth, and rightly yields it a respect for its great and generally benign influence over mundane existence. It is true that we feel "bully" in sunshiny weather, but sunshine is the accompaniment of certain atmospheric conditions not wholly shown by the thermometer or the solarimeter. A few sunless days or hours are not sufficient, however, to put a "hoo-doo" on the temperament and activities of a whole population; there is another important controlling agency, but little understood, even if appreciated, and it exercises a much greater influence than the sun in a given space of time. If the sunlight were absolutely necessary to our upkeep night watchmen and laborers on the morning editions would be chronic invalids, and mine workers the most unhealthy people in existence. If sunlight were necessary to animal life all of the night prowlers would cease to exist.

The gaseous envelope of atmospheric air surrounding the earth is the medium in which we have to live, and it bears the same relation to the human family as the waters of the globe to the order of fishes. The air and water are essential to life, as much a factor to man as the quality of water to the fish. This normal atmospheric air exerts on our bodies a definite dynamic force or physical pressure of 14.7 pounds on every square inch of our bodies, if we live at or near the sea level, and the higher up we go this atmospheric pressure diminishes until on the heights of the Rockies it is probably two pounds less. The normal pressure at sea level is indicated by the barometer as 30 (inches), and it decreases by an established scale as it ascends these mountain heights. Most persons know that ascents of mountainous peaks, thousands of feet above sea level, result in marked physical distress, difficult breathing, general depression at the summits, and in extreme cases bleeding at the nose and even from the lungs, due to this lessened atmospheric pressure. Just so it happens that when the barometer is "low" for a considerable period, say a drop from 30, the normal gage, to 29 or below, when stormy or dull weather ensues, we get the analogous effect imperceptibly, but in an appreciable degree; for it has happened that a definite measure of atmospheric pressure is released from our bodies and naturally there follows a dislocation of our normal balance. The average adult man sustains on every pleasant day an atmospheric pressure of about 14 tons at sea level, when the barometer reads at 30 and a drop of an inch or more, to 29 and below, practically takes off half a ton or more of his load to which he is accustomed. Paradoxically, instead of feeling lighter and freer, man feels its disturbing depressing effect on his tissues. He has to become adjusted to this alteration from normal tensity to one of unusual relaxation, and while it is slow in its manifestations, as barometric changes are generally gradual, yet the effect in miniature is like going up to a great height on a mountain range. Of course this feeling is neither serious nor fatal, but the relaxed condition in unpleasant weather extending over a number of days makes us feel "out of sorts." While the spell is on we are in the doldrums and the situation is recognized as of enough importance by careful surgeons, who weigh every factor, to defer important operations which can be postponed, when these unfavorable barometric conditions prevail, and the patient needs every ounce of vitality to pull through.

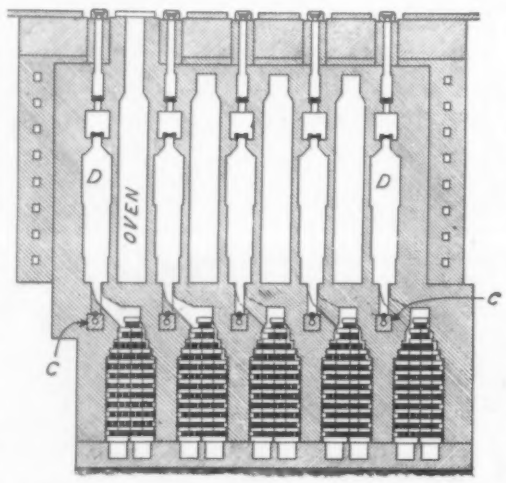
It is just as well to know these fundamental facts about the influences which affect our physical being so that we can estimate that "tired" or "good-for-nothing" feeling which accompanies a spell of dull weather; to know that it has a definite and transitory cause outside our bodies. It is really an explanation of the ups and downs of our healthy existence. Naturally there is no remedy to be prescribed. As Mark Twain said about the weather—we talk a lot about it, but we never do anything to improve it.



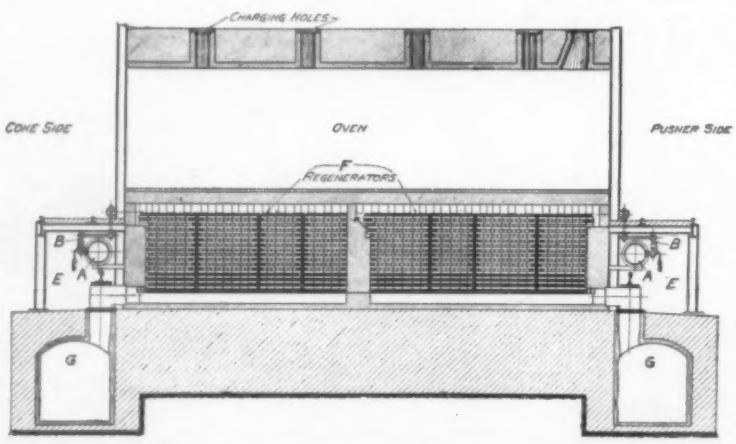
Method of controlling the heat in the horizontal flue oven.



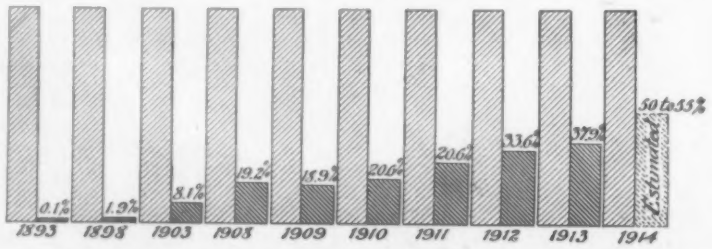
Horizontal flue type of coke oven.



Cross-section, showing the regenerators and the vertical heating flues at each side of the oven.



Longitudinal section of an oven chamber (vertical flue type), showing regenerators.



Ratio of by-product to beehive coke since 1893. The former is represented by the heavily shaded columns.

Cancer and Radium

A TIMELY warning against blind faith in the cure of cancer by radium was addressed to the public recently by representatives of the American Society for the Control of Cancer.

The radium treatment of cancer is as yet a matter of experiment, and the successful results have been obtained chiefly in the treatment of external cancers, particularly of the skin. Even granting that in the course of time radium may prove of much greater value than has been the case in the past, it was pointed out that a sufficient quantity of radium and the required experience in its use will not be available for some years, and in the meantime it is practically certain that large numbers of people are likely to be deluded by false hopes. The first principle in cancer treatment is the extreme danger of delay; and thus far a thoroughly qualified operation seems to hold out the only hope for a cure.

According to the opinion expressed by these speakers radium has probably been shown to exert a definitely curative effect on certain of the moderately malignant and superficial cancers of the skin, mouth and other readily accessible mucous membranes, provided that it is applied while the disease is still local and in the early stages.

Radium definitely relieves suffering when used in the advanced stages of deeper-seated cancers; but in those cases it improves only the visible or tangible manifestations and exerts no effect upon the disseminated disease as a whole. It is believed that there is as yet no proof that radium has finally cured any one case of advanced and disseminated cancer.

The Mechanism of the Player Piano

IN the manufacture of actions for player-pianos there are 20,000 operations from the raw material to the finished product and a total of 4,063 individual parts enters into the making of each action.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Compulsory Licenses

To the Editor of the SCIENTIFIC AMERICAN:

I would like to call your attention to some defects in the argument of Commissioner of Patents Ewing against the introduction of the compulsory license and compulsory working of patents in this country, which is found in your issue of March 13th.

The Commissioner says: "The difficulties are economic. They are very acute in Great Britain in spite of provisions of her patent system which we are urged to adopt."

The British working clause of 1907 caused an immediate development of manufacturing which had previously been conducted in foreign countries. Not long after the law was passed, a decision by Judge Parker placing the burden of proof on the petitioner for revocation practically nullified the working clause. Advocates of a working clause are not urging the adoption of the provisions of the British patent system. They are advocating the adoption of an effective working clause in the United States law which will put an end to the present humiliating conditions under which the United States law is now used by foreigners to suppress industries in the United States and develop them in foreign countries.

Moreover, the British Act can no longer be considered ineffective, for on February 22nd the president of the British Board of Trade, Mr. Runciman, made this statement in the House of Commons showing that the British working clause will work in the future:

"The success of the (dyestuff) concern must depend largely upon the way in which German patents are administered, and it is the intention of the government not to cripple the company after the war was over, but to give them every opportunity of making the most of the German patents."

Commissioner Ewing's reference to treaties with foreign nations gives the impression that something terrible would follow the enactment of a working clause in our law to correspond with the working clause that Germany has enforced for over forty years and which England intends to enforce and would have enforced eight years ago but for a technicality in the interpretation of her statute. If our patent treaties are of that one-sided character, they are evidently in need of change. The Commissioner, without giving its terms, refers to the Bernstorff-Bacon patent treaty of 1909 as if it were advantageous to the United States. That treaty was negotiated in secret immediately after and evidently because of the agitation for a working clause that started in this country in 1907. The public knows very little about this Bernstorff-Bacon treaty. Instead of being to the advantage of the United States it is very much to the advantage of Germany, as will be clearly seen from the following provision:

"The working of a patent, working pattern (Gebrauchsmuster), design, or model in the territory of one of the contracting parties shall be considered as equivalent to its working in the territory of the other party."

For forty years the United States protected and developed the German dyestuff monopoly by giving German owners of patents an unqualified patent protection in this country, while during the same period Germany developed her industries by an effective working clause. But when Congress proposed in 1908 to enact a working clause for the development of American industry the Bernstorff-Bacon treaty was negotiated to nullify the effect of any working clause Congress might enact by providing that working an invention in Germany shall be equivalent to working it in the United States. This may have been a triumph of diplomacy, but in view of the relative development of manufacturing based on patents in the United States and Germany it cannot be called a triumph of American diplomacy.

The European war has disclosed the industrial dependence of the United States on foreign countries. The most striking illustration of this dependence is found in textile manufacturing, an industry giving employment to over 1,000,000 people and producing annually over $2,000,000,000 worth of goods, and whose existence is mainly dependent on the importation of $10,000,000 worth of dyestuffs from Germany. This perilous situation has existed for years and has been known to everyone acquainted with conditions in the textile industry. The only difference now is that the European war has stopped the German supply of dyestuffs and aroused the entire country to the humiliating position occupied by a country accustomed to boasting of its independence.

The problem involves other factors besides a working clause. A protective tariff will be required for the establishment of a dyestuff industry in the United States. There will have to be co-operation between science and industry, such as exists now in Germany. If the United States is to develop this industry, we must employ all the methods that Germany has found useful, and among these is an effective working clause in the patent law. Those who are experienced in the administering of patent law can render a valuable service to the public by pointing out how such a law should be framed so as to be effective without creating any difficulties to offset the advantages.

SAMUEL S. DALE.

Boston, Mass.

[So far as our correspondent's contentions relate to the coal tar chemical and dye industry, we would refer him to the paper by Dr. Bernhard C. Hesse on the "Contribution of the Chemist to the Industrial Development of the United States," read before the fiftieth meeting of the American Chemical Society at New Orleans. We cannot do better than quote the following from that excellent consideration of the subject:

"France, in the early days of the coal tar dye industry, was an important factor in the invention and in the manufacture of dyes; the same with Great Britain. France has always had a drastic working clause; in 1907 the British working clause was brought about at the insistent agitation of dyestuff makers of Great Britain, and they promised, in effect, to the British public, that if that working clause were enacted into statute, an independent British coal tar dye industry would spring up at once. After the law had been in operation six years and a half and Great Britain could no longer deal with Germany, what was the result? Was Great Britain able to supply its own needs of coal tar dyes? Certainly not. Was France? Certainly not. Now, since neither of these countries was able to supply its dyestuff needs, when it could no longer trade with Germany, was the working clause the cause of that condition? If not, what was? Certainly the working clause did not prevent that condition from arising. If the British working clause, the last, and presumably the best of the fifty-six measures now in force attempted compulsory working, absolutely and utterly failed to produce in six and one half years a coal tar dye industry, when it had at that time five coal tar dye factories of its own—each of them at one time or another making some of their own intermediate products and some of them at times even exporting to Germany—if those five British dye works *plus* the new British working clause could not produce the six million dollars' worth of dyes a year that Great Britain imported in 1912, and make themselves independent of Germany, on what grounds and by what course of reasoning has anybody the right to assume that if we were to put the British working clause bodily on our statute books, we would create a large coal tar dye industry, at once or within *any reasonable* time? . . .

"At the meeting of the Imperial Industries Club of Great Britain, April 1st, 1914, the compulsory working of patents was discussed. No one speaking in favor of the 1907 British Act named any specific cases of any new industries being brought to Great Britain thereby. Those speaking against the Act referred to case after case where foreigners revoked the British patents and then dumped foreign-made goods on the British market. Lord Moulton said of this British Act: 'It is no use arguing about legislation of that kind. It is self-condemned.'

"Those who have spoken favorably of this British Act with but one or two exceptions have colored their statements; for example, one new plant was represented as employing 1,600 people—it employed only 37; another represented at 600 employees, employed 60. There are no official figures as to the real effect of this Act; the only figures are those of real estate agents having land and factories for sale; under these circumstances their fail from truth is understandable, but it does not make it their credibility. . . .

"Furthermore, it must be remembered that on July 13th, 1832, the President of the United States approved an act compelling all foreigners to work their patents in the United States under penalty of automatic cancellation. That act was repealed July 4th, 1836; it died at the tender age of three years, eleven months, and twenty-two days. If it was bad policy for us then, and experience proved it to be, why should it be good policy for us in 1915 to try the same thing over again? It has not worked in any of the fifty-six countries that have tried it. Why should it be successful after so many failures under present conditions and why should it be successful when the old conditions, under which it invariably failed, return?"

The whole tone of our correspondent's letter implies that patents are the basis of the dyestuff industry, and that since Germans own the patents Americans are helpless. According to Dr. Hesse, whom we quoted in our issue of September 26th, 1914, on this subject, out of a total of 912 coal tar dyes, 467 have never been patented in the United States, and the patents on 239 further dyestuffs have expired. Only 215 of these dyes are at present protected by patents. Of those dyes which we are at liberty to manufacture only about 10 per cent are actually made here, and these very largely from imported coal tar products not themselves dyes.

Our correspondent is wrong in supposing that Germany has a very drastic working clause. As a matter of fact, Germany's working clause is so liberally construed that the most perfunctory compliance with its terms is accepted. Indeed, Germany retains her working clause not because she believes in it, but simply because she can use it as an effective weapon against those countries which threaten to hamper foreigners by injecting into their patent system revocation and compulsory license clauses.

The Bernstorff-Bacon Treaty, which our correspondent regards as decidedly anti-American in its effect, is in reality a boon to American manufacturers. German courts have interpreted the treaty so liberally that, as a matter of fact, America stands in a better relation to the German patent system than Germans themselves. The experience of the National Cash Register Company is a case in point. Patents owned by that company had been assigned to a German; they had never been worked even in the perfunctory fashion required by the law. A petition was made by a German firm for the revocation of the patents. The court held that even though they had been assigned to a German and were in effect outside of the treaty, nevertheless it considered it necessary to place them outside of the provisions of the working clause. In other words, the invention was American, and because it had been originally patented by an American in Germany, the court refused to apply the German working clause to it. If this is the manner in which the Bernstorff-Bacon Treaty works, we would dislike to see it repealed.

We are in accord with our correspondent when he states that there must be co-operation between science and industry as exists now in Germany. There must also be co-operation between government and industry. What we want is more encouragement and less opposition from our legislators.—EDITOR.]

The Death of Cecil Peoli

IT is with great regret that we have to record the death of Cecil M. Peoli from a fall of about one hundred feet in a new machine with which he was experimenting for the U. S. Navy. This aeroplane, which had a spread of 48 feet and was fitted with a 140 horsepower 12-cylinder V-type motor, appeared to be tail-heavy on its trial flight at the Aviation Field at College Park, Md., with the result that it crashed to the ground soon after young Peoli had arisen and while he was flying at a height of 75 to 100 feet. The aviator, who was but twenty-one years old, was crushed beneath the motor and killed instantly. Cecil Peoli was one of the leading American boys to make and fly model aeroplanes. His record-breaking model was described by himself in the SCIENTIFIC AMERICAN a few years ago. He afterward became an aviator under the tutelage of Capt. Thomas A. Baldwin and flew the latter's machine for a couple of years. In 1913 he made a trip to South America, where he flew over the Andes, and, on one occasion, had a very close shave from crashing into a peak of one of these mountains while flying in a fog. He managed to swerve sharply just in time and to descend safely to the coast from which he started. It is indeed the irony of fate that so young a life should be snuffed out as a result of a slight fall when the aviator had been through such dangerous experiences. While his machine was intended for the Navy, Peoli was experimenting above land, as he had never flown an hydro-aeroplane. Had he experimented over the water, in all probability he would not have been killed. This is another proof that no matter how expert the flier, he will do well to experiment over water rather than over land.

Prof. C. W. MacCord Dead

CHARLES WILLIAM MacCORD, professor emeritus of Stevens Institute and noted as a leading authority on all matters relating to mechanical drawing, died recently at his residence in Hoboken, N. J., at the age of 86 years. He was born in Dutchess County, N. Y., and graduated from Princeton University with the degree of A. B., later taking the Masters degree, and in 1881 receiving the degree of Sc.D.

For many years he was employed as a draughtsman by Capt. John Ericsson, during which time he drew the plans for the "Monitor," the original turreted war vessel that defeated the Confederate iron-clad "Merrimac." In 1871 he became professor of mechanical drawing and designing at the Stevens Institute, and held this chair until his retirement in 1906. Prof. MacCord was at one time a frequent contributor to the SCIENTIFIC AMERICAN, and was the author of a number of works on mathematics, geometry, and draughting.

Protecting the Eyes of Railroad Employees

WITH the object of protecting its employees against permanent injury to the eye or loss of sight, the Baltimore & Ohio Railroad Company, in a circular just issued, urges that in all cases of injury or of the lodgment of foreign particles in the eye, the employee at once seek the services of a company physician, whenever this be possible, rather than attempt to treat the injury or allow fellow employees to do so. Railroad experience cites many instances of permanent injury to the eye or total loss of sight sustained as the result of attempts by inexperienced persons to usurp the office of surgeon. The immediate securing of medical attention, it is held, eliminates the possibility of infection.

To Old Readers of the Scientific American

THE June number of the SCIENTIFIC AMERICAN will commemorate the seventieth anniversary of the house of Munn & Co. In that number we wish to give a history of the SCIENTIFIC AMERICAN. Old readers and subscribers who visited the editorial offices in the past are requested to send us their impressions, anecdotes, experiences, and the like. Indeed, any information at all relating to the old offices on Park Row will be gratefully received by the Editors.

Saving Eight Million Tons of Coal a Year

A Hydro-Electric Development That Uses a Head of 4,000 Feet

FED by the snow caps of the Sierra Nevadas about seventy miles east of Fresno, Cal., is a stream that flows with much fuss and bluster down the mountain sides to the San Joaquin River. Locally this stream is known as "Big Creek." But despite its ambitious name, one may search in vain for a trace of it in the common atlas. Now, however, its ambitions are about to be realized, for in one respect at least it is to surpass the mightiest river of the continent. A Government permit was recently granted to a light and power company to extract from this mountain stream 350,000 horse-power—more than will be obtained from the great Mississippi River when the hydro-electric development at Keokuk is carried to completion!

This astonishing disparity of size and power disappears when we learn that above Keokuk the Mississippi has a fall of but 23 feet in twelve miles, while Big Creek in half that distance drops 4,000 feet. And a copious amount of water pours down the precipitous course; for Big Creek drains a basin of about 88 square miles, which with an annual rainfall of more than 80 inches gives a run-off of about 50 inches. This basin, 7,000 feet above the sea, forms a natural trap for the moisture-laden winds from the Pacific. On the south and west it is bounded by comparatively low ridges, but on the east the peaks of the Kaiser range rise to elevations of 10,000 and 11,000 feet, and so the moisture sucked up from the Pacific is carried by the wind over the southern and western ridges, only to be precipitated against the cold peaks of the north and east. With plenty of water thus assured and an enormous head, conditions are ideal for the generation of electricity.

California is famed for its enormous hydro-electric achievements, but in the work already done we have something to astonish even the Pacific coast. Here is by far the largest high head development in this country. It employs the most powerful impulse wheels ever built and the largest electric generators of their type. The current is transmitted over the longest "express" line in existence, at the highest voltage ever used commercially.

The permit acquired by the Pacific Light and Power Corporation of Los Angeles to develop the power of Big Creek allowed twelve years for the completion of the work. But with great enterprise the company set a record for rapid work in completing the initial development inside of two years. The first work was to build a railroad 56 miles long to reach the site of the development. This road was finished and equipped in 157 days. Then three concrete dams were constructed to close gaps between the ridges bounding the basin in the mountains, thus making the reservoir 7,000 feet above the sea, four and one half miles long by half a mile wide, with a capacity of about 53,000 acre-feet. The capacity will later be increased to 120,000 acre-feet by raising the dams 50 feet higher.

The fall of 4,000 feet has been utilized by leading the water through a tunnel and steel pipe lines to the first power house half way down, and then through another tunnel and series of conduits to the second power house. Some conception of the enormous drop from the basin to the first power house may be gathered from the accompanying photograph in which the three tallest buildings in New York have been drawn to serve as a scale. If on top of the Woolworth Building were placed the Singer Building and on top of that the Metropolitan Tower, their combined height would just about equal that of the reservoir above the first power house. Driven by this mighty head, the water rushes out of the 6-inch nozzles at the power house with a velocity of 350 feet per second, which is about 240 miles per hour. The jets dash across an open space of a few inches and then strike the buckets of the impulse wheels, which spin around as fast as the drivers of an express locomotive traveling 100 miles per hour. These wheels are 94 inches in diameter and are arranged in pairs, each pair developing 23,500 horse-power. Despite the enormous velocity of the jet, there is no shock at the impact with the water wheel, because the part of the bucket first touched is nearly parallel with the jet.

After passing through the first power house the water discharges into the creek. But the creek is here blocked by dam No. 4 and the water is diverted through a second tunnel four miles long into a second series of steel conduits leading to the second power house.

In each power house there are two main generators of 17,500 kilowatts capacity each. Here the current is generated at 6,600 volts and raised by transformers to 150,000 volts. The current is carried to Los Angeles, 240 miles away. Two lines of steel towers on a right of way 150 feet wide will carry six cables an inch in diameter, from the two power stations to a substation at Eagle Rock, in the suburbs of Los Angeles.

In less than a year and a half after the work at Big Creek was begun both power stations and one transmission line were in operation and current generated at Big Creek was in commercial use at Los Angeles. This involved the setting of more than 3,000 steel towers over the mountains and across the desert and the stringing of nearly 5,000,000 pounds of aluminium cable. It is interesting to note that, by virtue of the great elevation of the reservoir above the two power plants, every cubic yard of water it contains is worth from ten to twenty pounds of coal, considering that it takes from four to eight pounds of coal to generate one horse-power in a steam plant. When the full possibilities of the Big Creek development are realized it will form an inexhaustible mine of energy with an output that could not be equaled by the consumption of over eight million tons of coal per year in a very efficient power plant. It represents that much saving of our limited and rapidly diminishing natural supplies of stored energy.

We are indebted to the Stone & Webster Construction Company, who were the constructing engineers, for the accompanying illustrations and details of this remarkable work.

A New Searchlight for the United States Navy

By Herbert T. Wade

THE probability that battles will be fought largely at night and will begin at an extremely long range in the naval warfare of the future and the increased importance of torpedo and torpedo-boat attacks make the searchlight of the modern battleship an important weapon of offense and defense second only to the guns themselves. Accordingly, improvements are taking place in such apparatus, and the United States and other navies are trying out new devices to secure greater effectiveness.

Recently the United States Navy has secured a searchlight of somewhat novel form which already has found a considerable application in Europe, both for ships of war and for coast defenses. This searchlight, which is 44 inches in diameter and so far is the largest instrument of the kind yet installed in the United States Navy, has, instead of the usual silver, a gold mirror, which can be controlled automatically from a distant station by an observer at the telescope. With the installation of 14-inch guns and even larger weapons on recent battleships concussion is apt to prove disastrous to the mirrors and mechanism of searchlights of the older types, and it even has been rumored that in certain foreign navies these searchlights have been dismounted at the time of practice with the heavy guns.

The searchlight, it will be recalled, is a powerful electric arc lamp placed at the focus of a parabolic mirror, which is carefully shaped or figured so that it will project a beam of rays approximately parallel and in any desired direction, being capable of movement and control, so as to sweep the horizon and illuminate any object within its range of visibility. These mirrors, like those of the reflecting telescope of the astronomer, are usually made of glass with a film of silver deposited on the surface and then highly polished. The best reflectors for searchlights have been made in Europe, it being only recently that American manufacturers have taken up the making of such mirrors.

Obviously, the mirror of glass at best is delicate and is likely to crack from shock or concussion, while a silver surface is, in addition, liable to corrosion. When it is considered that searchlights with mirrors of more than six feet in diameter are required for purposes of coast defense, it will be seen how serious such a difficulty is; and when it is further considered that a chance hit by even the smallest projectile is likely to put the apparatus permanently out of service, the necessity for improvement in the design and construction of a searchlight may be appreciated.

The new mirror of the United States Navy Department, designed by J. A. Rey, in France, makes use of an important improvement by substituting gold for silver as the reflecting surface. This film of gold is electroplated in a parabolic surface formed from a massive casting of bronze, which is turned to the approximate shape and then is figured out as accurately as possible. Not only can such a mirror withstand the shock and concussion to a greater degree than one of glass, but even if the reflector itself is pierced by a bullet or small shell the apparatus may not be seriously damaged. But equally important are the improved optical properties which the gold surface affords. There is a marked increase in visibility, by which is not meant the greater photometric efficiency, but the projection of the rays toward the red end of the spectrum instead of greater amounts of the blue and the violet or shorter rays which are reflected out from a silver surface. As a result, the more mellow light of the gold mirror lights up the distant ship or other target at a distance with a soft illumination that shows detail and affords greater convenience in sighting to the gun-layer.

The advantages claimed for the gold mirror are rather in the direction of an efficiency and effectiveness as regards the special work in hand than securing a greater intensity of illumination. Thus, in the case of a fog or haze the gold beam is able to pass through the atmosphere containing water vapor, mist, or rain in fine drops more effectively than the beam from the silver reflectors.

The 44-inch searchlight, the largest yet to be tested for the United States Navy, has been tried last year on the battleship "Arkansas," and as a result of preliminary tests was acquired by the Navy Department. In addition to possessing a gilt mirror there is an interesting mechanism for distant control, which adds greatly to the effectiveness of the installation. The searchlight may be mounted at any desired point of the superstructure, where it may have a range of 180 degrees in a horizontal plane with sufficient vertical adjustment for all ordinary purposes. At the bridge or other convenient position for the observer there is a pedestal with a telescope.

The observer, with eye to the telescope and shoulder at the arm rest, moves the latter so as to keep his cross-wires focused on any desired object or target, and the corresponding motion is communicated to the searchlight, so that observer or gun crew may follow the motion of an approaching torpedo boat or other target. The control of the motion is effected through the familiar Wheatsone bridge principle and provides for the movement of the distant electric motors at the searchlight supplied with current from the ship's mains, so that motion is imparted to the searchlight corresponding to the motion of the telescope of the observer. Furthermore, the observer is able to control the illumination of the searchlight both by means of a shutter and by dimming the arc so that its full intensity need only be used when desired without undue expenditure of carbons or energy. The carbons employed are 20 millimeters in diameter in the case of the upper carbon and about 10 inches in diameter for the lower, the upper carbon being arranged horizontally so that its crater is always in the focus of the parabolic mirror. The system of control just outlined is also the invention of J. A. Rey and is covered by foreign and American letters patent. Similar installations have been used in the leading European navies and also for coast defenses and for portable searchlight battalions, which are an important feature of continental armies.

Longitudes by Wireless Telegraphy

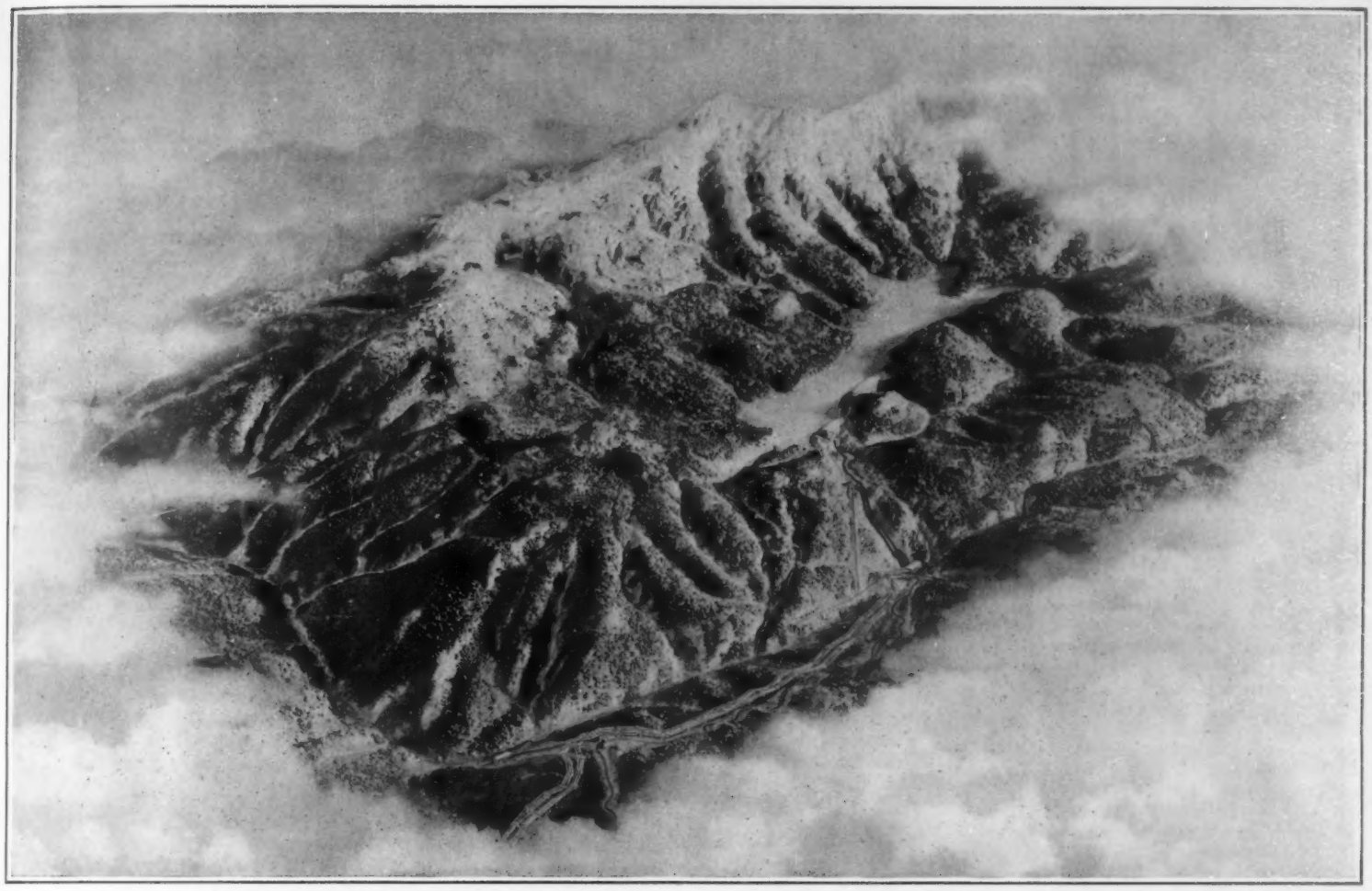
By Prof. F. B. Littell, U. S. N.

ONE of the important scientific uses to which wireless telegraphy can be put is the determination of differences of longitudes. For this purpose it is only necessary to make a signal at any wireless station and to have this signal received and the time noted at the points whose difference of longitude is to be determined. For the determination of the time with accuracy it is necessary to have recourse to astronomical observations. Where the highest accuracy is desired, it is necessary to make a correction for the time of transmission of the signal, but as wireless signals travel approximately with the speed of light, this correction is very small.

This method is particularly applicable to the determination of the longitudes of places not on telegraph lines, and this opens up a broad field for its future usefulness. The question as to whether it could be utilized for transatlantic longitudes has been answered in the affirmative by the successful work of the American and French parties in the winter of 1913-1914 in determining the difference of longitude between Washington and Paris, and it has been shown that for the connection of important places where high-power wireless stations are available, there is great advantage over the previously employed cable methods.

As in this case there was wireless transmission in both directions, the transmission time was also determined with a fair degree of precision. The time of transmission from Washington to Paris or *vice versa* is only one-fiftieth of a second, and it is evident that the work of the radio observers must have been very excellent to determine so small a quantity with a probable error of only 10 per cent of its value or one-five-hundredth of a second.

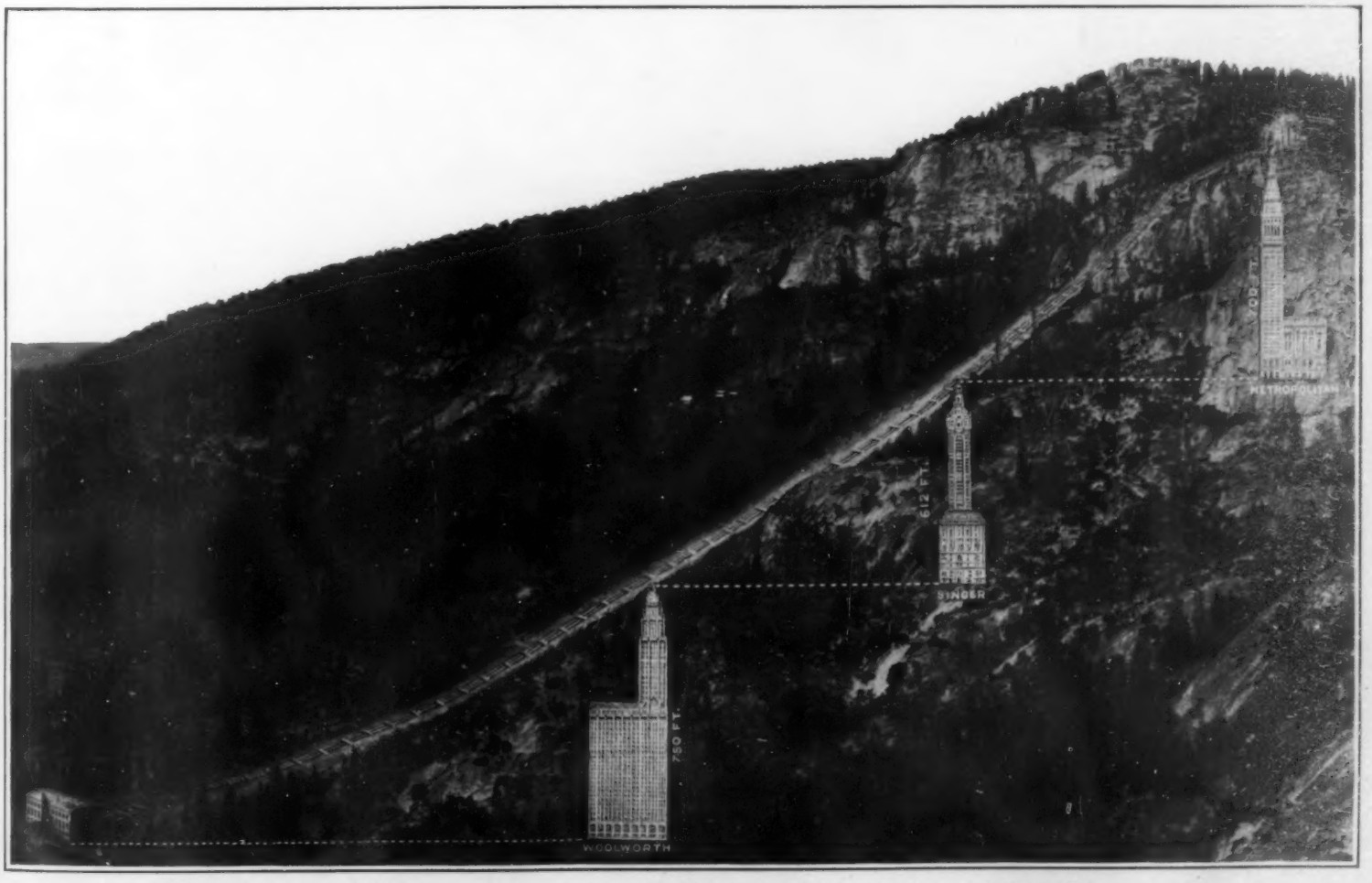
A full account reprinted from the *Astronomical Jour-*



Bird's eye view of the Big Creek initial development, showing the two power plants and the transmission lines leading from them.

nal of the work of the American observers will be found in the SCIENTIFIC AMERICAN SUPPLEMENT of the current issue. This marks the most notable advance in method since the introduction of the use of the submarine cable in 1866 by Dr. B. A. Gould of the U. S. Coast Survey. The proposition to make the determination originated with the Naval Observatory, but the technique of the method had already been developed by the French geodesists and astronomers, who have applied it extensively on land lines. The close agreement of the values obtained from this work with those obtained from the cable determinations furnishes an excellent tribute to the care and skill with which those determinations were made.

Converting the Car Into a Sleeping Compartment.—E. L. Thompson, of Glenns Ferry, Idaho, has secured patent No. 1,131,875 for an auto body in which the side portions of the front and rear seat are so supported and operated in connection with supplemental cushions that the vehicle may be readily converted into a full sleeping compartment or one in which a bed surface extends practically throughout the length of the auto body or a partial sleeping body in which the bed will extend from the back of the rear seat to the back of the front seat, the latter being intact so the driver can continue to operate the machine.



The head of water at the first power plant equals the combined height of the Woolworth, Singer, and Metropolitan towers.

The Sound Wheel, a Novel Wireless Detector

By the Berlin Correspondent of the Scientific American

THE measuring of extremely small currents of a frequency of at least 30,000 per second, as used in wireless telegraphy, of course, affords enormous difficulties. Whereas direct-current galvanometers, capable of gaging currents of, say, 10^{-8} ampere, are readily obtained by providing a sufficiently strong magnetic field, it is quite impossible to do the same in the case of alternating currents, unless the magnetic field be excited by an alternating current of exactly the same frequency, which is obviously quite impossible.

Dr. R. Goldschmidt, the inventor of a wave generator, has had a fortunate idea in utilizing to this end the principle embodied in the Leblanc commutator machine, which, as is well known, mainly consists of a rotating commutator. The segments of this machine derive their tension from the terminals of a transformer, the conversion of alternate into direct current being effected by simple commutation.

In order to insure a sufficient rate of commutation, Dr. Goldschmidt, however, simplified this apparatus by substituting for the commutator a toothed disk which, so far from reversing the current, only breaks it once in every wave. If the currents to be gaged have a frequency of, say, 40,000 cycles per second, and if each tooth of the wheel is 1 millimeter in width, there will be a synchronous rotation for a peripheric speed of 40,000 × 1 millimeter = 40 meter-seconds; that is, for a perfectly practicable speed. On account, however, of the impossibility of a strictly synchronous rotation, Dr. Goldschmidt arranges the wheel to rotate intentionally at a synchronous speed, choosing, e. g., for 40,000 cycles, a frequency of interruption of 39,000 or 41,000. The transformed current then takes the form of an alternate current of the frequency 40,000 — 39,000 = 1,000. The number of turns of the wheel need not, however, approach the synchronous speed; generally speaking, any odd fraction of this speed will be found sufficient. If an alternating current of given frequency be applied to the "sound" wheel, as the apparatus is termed, the wheel passing slowly from its state of rest to the normal number of turns, the sound will pass through the whole scale, and a continual singing will be heard in the telephone receiver until about one-third of the normal number of turns is reached. An interval then occurs which lasts until close to the speed of synchronism. If the contact brush be of sufficient width, the same sound phenomena will also take place with even fractions of the synchronous speed.

Experience has shown the wear and tear due to the milling effect between the toothed wheel and the brush to be extremely small. The brush is made of copper wire or of copper plate embedded in some insulating material, which has been found very helpful in damping vibrations.

The wheel is actuated by a motor, the speed of which is controlled automatically by a centrifugal contact device and a Foucault current brake. The terminal supplying current to the wheel is placed as close as possible to the contact brush.

The "sound" wheel is at least equivalent to any one of the detectors so far known, as far as its sensitiveness is concerned. It has been used with most satisfactory results in the transatlantic service of Messrs. Hochfrequenzmaschinen A. G. (High Frequency Generators, Ltd.) between their stations at Ellvese and Tuckerton, respectively.

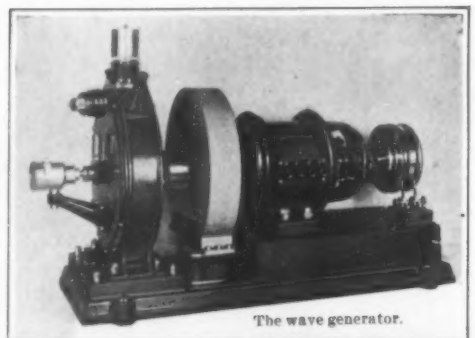
In a recent paper, Dr. Goldschmidt sums up as follows the main advantages of the sound wheel:

1. Damped waves are received as noises rather than sounds.

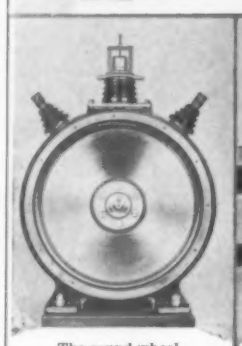
2. Stations using slightly different wave-lengths are heard with widely different pitches. If, e. g., the sound wheel works at 39,000 revolutions per minute, while the transmitting station gives out waves of 40,000 cycles, a sound of 1,000 cycles will be received. Another station using a wave 2½ per cent shorter, that is, of 41,000 cycles, would already be heard with a sound of 2,000 cycles, that is, twice the above, which, of course, makes discriminating between different stations very easy.

3. The sounds heard in the receiver come out most clearly against any atmospheric disturbance.

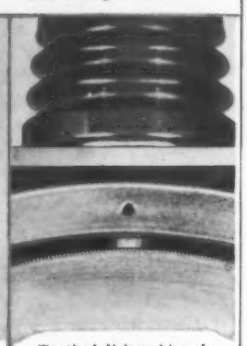
4. Each telephone, of course, responds best to a given note. As, however, the pitch of sound is adjusted at will, the one corresponding to the optimum of the receiver can be readily selected. In fact, the receiving intensity may thus be reinforced at the ratio of 1 : 10.



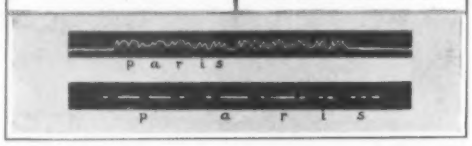
The wave generator.



The sound wheel.



Toothed disk and brush.



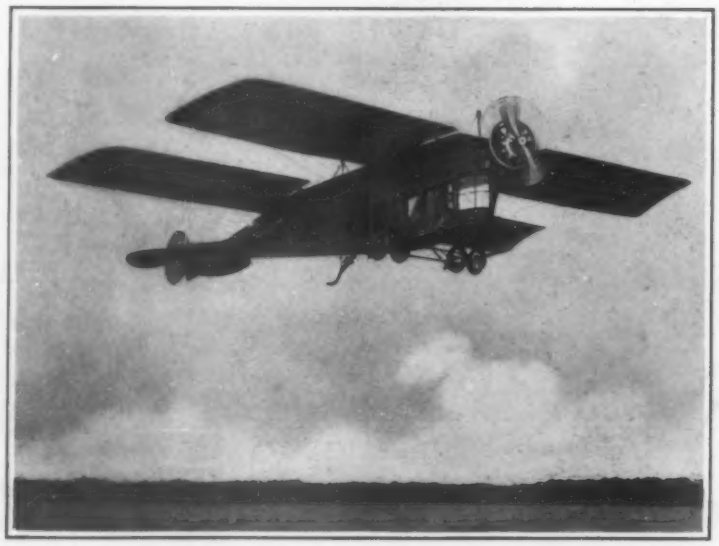
Radio-telegram received with ordinary detector (above) and with sound wheel (below).

In view of the remarkable sensitiveness of the sound wheel, Dr. Goldschmidt has made a series of experiments on this apparatus combined with a recording galvanometer. The most striking result brought out by these experiments is the fact that radio-telegraphic signals are received, not as a zigzag line, as in the case of ordinary telegraphic recorders, but in the form of a series of dots and dashes, corresponding to the Morse alphabet. Atmospheric disturbances make themselves felt at most in the form of slight deformations of these dashes.

The Albessard Aeroplane

AUTOMATIC stability and the comfort of passengers are the objects chiefly sought in the construction of the Albessard aeroplane, which is described in a recent issue of *L'Aérophile*.

The Albessard autostable aeroplane.



The Albessard aeroplane in full flight.

The body, or fuselage, is sharply pointed behind, but blunt in front, and is entirely covered. The forward portion forms a spacious cabin, inclosed by glass sashes, which protect the pilot and passengers from the wind and the fumes of the motor. The long and broad top of the fuselage is perfectly plane and is level in horizontal flight. Hence, it contributes nothing to support, but it opposes little resistance to the air and it assists in maintaining equilibrium.

The machine is supported by two pairs of wings, arranged in tandem in the same plane, like the wings of a dragon-fly. The wings are equal in area but are not equally loaded, as the front wings are more inclined than the rear wings. This arrangement also contributes greatly to horizontal stability. The distance between the two pairs of wings is sufficient to prevent "blanketing," as has been proved in trial flights.

The wings are provided with a warping device, as a measure of precaution; but in practice the machine is found to maintain its balance without the intervention of the pilot, because of the novel arrangement of its central surfaces, its deep vertical keel, and its low center of gravity. The steering and elevating rudders are at the stern, the tractor screw at the bow.

In trial flights the aeroplane maintained a remarkably straight and regular course. A very gentle landing can be effected by gradually stopping the motor, without using the elevator. No mishap has yet occurred in landing.

The dimensions of the machine are:

Total length of fuselage	46	feet.
Width of horizontal top	8	"
Depth of keel, at junction with cabin	5¼	"
Width of cabin	3	"
Width of each wing	16½	"
Length of each wing	7¼	"

On the ground the machine is supported by a strongly built chassis, mounted on four orientable wheels.

The tractor screw, about 9 feet in diameter, is driven by an Anzani motor of 85 to 100 horse-power. This motor, however, has proven insufficient for a machine of this size and weight, and a new series of trials will be made with a motor of 160 to 200 horse-power.

The experimental machine in its present condition and unmanned weighs 1,760 pounds, and develops a speed of 46 to 47 miles per hour.

An Investigation of Vegetarianism

WHAT is there in a vegetarian diet that makes its enthusiastic advocates so staunchly defend it against all criticism? We hear much of the value of suggestion nowadays in treating a wide variety of maladies. After reading the report of one of our most noted investigators, Dr. Benedict, on work done in collaboration with Paul Roth in studying the effect of a vegetarian diet upon the human system, one wonders if, after all, it is not the idea as much as the diet that is efficacious in bringing about good health.

In at least two instances it has been proved by these investigators that the arguments made by vegetarians for their particular brand of diet are fallacious. It is claimed by vegetarians that a diet containing an appreciable amount of protein over-stimulates the process of digestion and assimilation.

According to the writers, the best method for testing this, and one which is considered very satisfactory, is a comparison of the basal gaseous condition of the two types of eaters. By the term basal gaseous condition is meant the amount of carbon dioxide produced and oxygen consumed when the body is in complete repose at least twelve hours after the last meal has been eaten.

In the experiment, respiration records, obtained by means of a special apparatus used in all work of this kind, were made on several consecutive days on eleven men and eleven women, nearly all of whom had not eaten meat for several years. Records were taken also for the same number of men and women of similar weight and height who were meat eaters. When the two sets of data were compared they were found to be alike almost exactly.

The second assertion made by vegetarians which was put to test was that meat eaters have less endurance and strength than have those who eat a minimum amount of protein. This claim is based on the assumption that those whose diet consists largely of carbohydrates will have stored up in their body a larger quantity of glycogen, which during periods of muscular activity is converted into energy. But the test disclosed no superiority of vegetarians over meat eaters.

Quite content on his lookout.

Elk enjoying a cooling dip in a lake at a zoo.

Animal Life in a Zoo

The Modern Way of Keeping Wild Animals

By Alexander Pope

SIXTEEN or seventeen years ago, when I first tried to interest the animal lovers of Boston in a zoological park, almost everyone admitted that Boston, like most of the prominent cities of the country, should have such an institution. There were, however, a good many people who called themselves the "friends of animals," who objected to it on the grounds of cruelty. One friend, an influential newspaper man, whose assistance would have been of great value in organizing and promoting such a project, stated emphatically that he was opposed to the whole scheme, and he did not want to see "half starved animals pining for their liberty." Since our Boston Zoo has been started and he has seen the conditions under which the animals are kept, he has changed his ideas entirely. If, of all the animals in a zoo the newcomers could vote on the question of whether they should be allowed their liberty or continue in their present condition, I have no doubt that the vote would be overwhelmingly for liberty; I also have no doubt that if at the end of three months it were possible to get the votes of the same individuals, as to whether they would remain at liberty or return to the zoo, a large part would vote to return. Mr. Pocock, director of the London Zoo, once said that he believed a majority of the animals in his care were actually happier than in their wild state, and it is my belief that he was correct in his opinion. One of my own family once said that such a statement was absurd, and asked me if I shouldn't be happier being free to go where I chose than if confined in an elegant mansion and surrounded with every luxury except liberty? Perhaps if I were in fear of my life I might prefer the mansion with restricted liberty, but to compare a man's state of mind with an animal's is unreasonable. An animal does not have a man's hopeless feeling in confinement, he knows he is restrained for the time being, but he does not feel the shame and disgrace, the shattered hopes and ambitions of the human prisoner. Many persons who call themselves "friends of animals" know nothing of the conditions under which these animals live in a state of nature, and think that removal from large ranges, such as the deer and similar animals enjoy in the open, is more of a privation than it really is. There is one thing certain, and that is that the cruelty imposed upon animals in a zoological park is nothing to the cruelty shown one to the other, or rather by the stronger animals to the weaker, in a state of nature, the cat and the mouse being the most familiar instance. The life of all wild animals, from the smallest to the largest, is one continual struggle for existence, hustling for their food, rearing their young, and avoiding their enemies. It is the survival of the fittest, the fittest in this case being the strongest. I would advise anyone who has an unfriendly feeling toward a zoological park to read Mr. Charles Livingston Bull's book, "Under the Roof of the Jungle." Mr. Bull is a naturalist and a close observer of animals, and what he tells about life in the jungle he has learned from his own experience and observation in British Guiana. He says, "Everything in the jungle is in danger, everywhere stalks the grim specter." And again, "Life in the jungle is a tragedy, everywhere the killers lurk or roam—in the tree tops, among the trunks, down on the ground among the roots and underground, beneath the roots." Can such things be said of a zoo? Another convincing proof of the terror in which wild animals constantly live, is shown in Mr. Paul Rainey's motion pictures of the water-hole taken in the heart of Africa. A pair of antelope were seen coming out of the woods, into the opening where the water-hole was situated. Did they walk up to the spring as they would to a trough in a zoo, and drink what they wanted without any fear of interruption? Not at all; they came out a little way and stopped, looked and listened. Finding the coast apparently clear they came a little nearer, always cautiously and always looking in every direction for an enemy. Finally they reached the spring, and though very thirsty, they took only a few sips at a time, constantly looking and listening, always in danger. The same animals in a zoo have to take none of these precautions. At certain times of the day they do look intently and listen, not for fear of any enemy, but for their keeper, who brings them food. Perhaps these terror-stricken animals are happier than their civilized cousins in a zoo. Who knows? Perhaps the most contented animals in a zoo are the deer. These animals are always given a large range, generally with enough trees to provide shade if they prefer that to sunshine, and a shelter which they can use at night, if they choose. Their food is brought to them every day, and they have every opportunity to raise their fawns. There are no hunters or dogs to molest them, and nothing to cause them fear or anxiety. Man, their most dangerous and dreaded enemy

(Concluded on page 389.)

At dignified ease in his rock castle.

Buffalo feeding in a spacious range.

A cool rocky den for the polar bears.

A Clock Built of Straw

FROM Switzerland, the home of the watch and clock industry, comes the accompanying photograph of a clock made entirely of straw and willow withes. Of course there is no particular value in the use of this material, except to demonstrate the ingenuity of the clockmaker. In this clock there is not a single piece of metal. Even the chimes are made of straw put through a special process, so as to give them a ringing tone when struck. Instead of the ordinary swinging pendulum, this clock is provided with a see-saw movement, there being two weights on each side as shown in the photograph. One great difficulty in making the interior mechanism of the clock was to get the proper elasticity in the springs, which were pressed and turned into coils very much resembling Chinese bamboo. The clock is nine feet high with a face eighteen inches in diameter. The base is of wicker construction from which four heavy linked straw chains serve as guys to keep the clock properly balanced. The movement operates 24 hours on each winding. It took over thirty months to complete the clock.

A clock built of straw.

Vacuum System of Gasoline Feed

SOME time ago the SCIENTIFIC AMERICAN illustrated and described a system of supplying the carbureter of an automobile with fuel by means of a vacuum system in place of the common gravity or pressure systems. The new method uses a small auxiliary reservoir, which draws its supply from the main tank, be it at the rear of the machine or under the front seat. It is the vacuum produced as the carbureter uses up the supply of gasoline that is utilized to draw the fuel intermittently from the main tank. As a supreme test of this type of gasoline feed, the automobile shown in the accompanying engraving was fitted with an elevated front truck which tipped it to a sharp angle. At this angle the carbureter is far above the gravity tank under the front seat, so that it could not possibly get any gasoline from that source. The same is true of any cowl tank in the dash, and at this angle no pressure system could possibly force gasoline to the carbureter. And yet despite this sharp inclination the car was operated with perfect satisfaction with the vacuum system. The angle of the car, according to engineering tables of grade, is approximately the limit where gravity overcomes traction, and no car could climb a steeper grade.

Ample fuel feed at any grade.

Enormous Mass of Foam

AT first sight one would suppose that the mass of white shown beside the mill in the accompanying photograph is an ice jam. But it is on the wrong side of the mill dam, and, as the title indicates, it is foam instead of ice. This picture was taken on Rock Creek, Morrison, Ill. The foam was 85 feet wide, 40 feet deep, and 450 feet long. The ground had been covered with snow and there was a heavy rain, and the weather was greatly disturbed the day before the mass of foam began to collect below the mill-dam. It lasted about three days, and then gradually broke up and drifted away. It remained at its greatest dimensions for about two days. The novel sight was witnessed by hundreds of people, and could be seen for over two miles.

The "Serpentina" Car

ONE of the greatest drawbacks in the handling of automobiles in the close traffic of a city, particularly where narrow streets prevail, such as in Boston, is the comparatively large radius required for a complete turn of the car. Some of the taxicabs in New York will turn in an ordinary side street, but by far the majority of motor vehicles need a street of the width of an Avenue to turn around in. To overcome this trouble two New Yorkers have designed a novel type of car which they call the "Serpentina."

Essentially the chassis differs from an ordinary roadster chassis merely in the arrangement of the four wheels. Instead of having these wheels in the orthodox fashion, in pairs at front and rear of the chassis, the "Serpentina" car has one wheel at each side in the center of the car, and one wheel at each extremity, front and rear. The steering arm is so arranged as to turn the latter wheels in opposite directions. As a result the car practically spins around on its center wheels, the front and rear wheels standing at right angles to the axis of the chassis. Traffic policemen stationed at important points, such as Columbus Circle, did not trust their eyes when the car showed up for the first time. The driver swung the steering wheel around just as the car reached the policeman, and it performed a pirouette of the most amazing swiftness. Before the surprised policeman could open his mouth it had darted off in a right-angled direction—after having described an arc of 450 degrees.

An Electrically Operated Loader

THE accompanying illustration shows the construction of a novel electrically driven belt loader for handling large lump lime without appreciable breakage.

This form of electric loader is really a conveyor supported on two arms hinged from a post in such a manner as to be easily moved into a box car by hand, coal or other loose material being conveyed into the car and piled to any depth by the machine with the least amount of breakage. The chute usually is on the loader side of the car and is flexibly attached so as to follow the loader in all positions. It is used to advantage for handling coal and similar material. The chute can be located on the opposite side of the car and a deflector at the receiving end of the loader turns the coal as it comes from the chute in the direction of the belt, thereby reducing the breakage of coal and increasing the life and capacity of the belt. In loading coke, the loader is partly withdrawn and the chute placed on the side of the machine in position to fill the center of the car.

In order to reduce breakage when starting to load, the conveyor is tilted toward the floor by turning a crank at the rear end of the machine. This is quickly and easily done because of the balanced construction of the loader. The jack for raising and lowering the loader to accommodate it to cars of varying heights is mounted on the loader post and can be easily operated by one man. This is only necessary for large lump coal.

The loader is made with 16-inch or 24-inch belt conveyer for loading sized coal or with 24-inch steel apron conveyer for

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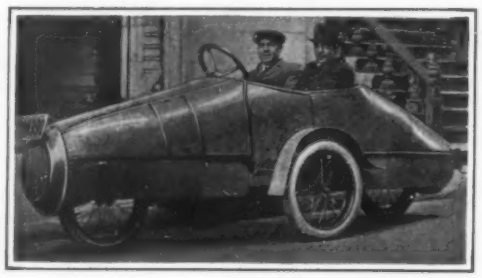
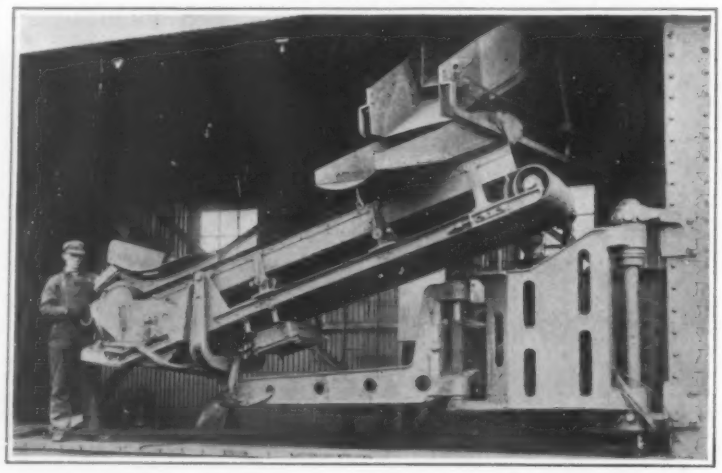


A car that can turn in its own length.



Belt loader for handling lump lime.

This is not an ice gorge, but an enormous mass of foam collected below a mill dam.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

CUFF BUTTON.—D. M. HENSLEY and E. M. SETHER, 123 South 2nd St., Decatur, Ind. The device connects the ends of cuffs of the link type, that is, where the ends are superposed face to face instead of being lapped upon each other, and wherein the button is formed from a single strip of material bent upon itself in such manner as to firmly clasp the ends of the cuff.

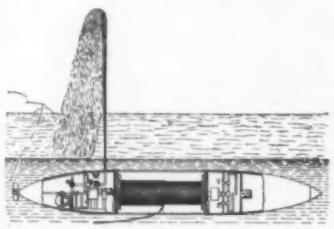
INITIAL BUCKLE.—L. SANDERS, 621 Broadway, New York, N. Y. The construction in this case permits of the letter plates being readily interchanged, insures their positive retention in position, and the form and arrangement of the face plate are such as to very effectively disguise its character as a means for holding letters, so that the interchangeable character of the letters is not obvious when the belt is worn.

PIN CATCH.—MARGARET L. NOXON, 205 W. 102nd St., New York, N. Y. The construction in this case permits of the use of the hat pin with hats of different types, and with the body or band disposed at the outer side of the hat, the pin tongue extending through the hat and coiffure of the person wearing the hat, and the point of the pin tongue being held by an S-shaped fastener.

SWEAT BAND FOR HEAD GEAR.—P. MERTON and C. S. MERTON. Address Charles S. Merton & Co., 810 Broadway, N. Y., N. Y. The sweat band consists of a lower strip of leather, chamois, or some similar material which can or cannot be washed, in conjunction with an upper strip of cloth primarily designed to match the interior of the hat or cap and to be sufficiently soft and flexible so as to permit the headgear to be blocked with the sweat band therein, thus avoiding the usual crease or ridge in the crown where hats or caps are blocked with the wide leather sweat band, especially due to its stiffness.

Electrical Devices.

TORPEDO.—G. P. HELFRICH, 976 Fox St., Bronx, N. Y., N. Y. In this invention the construction gives a visual sign as the same passes through the water whereby the course of the torpedo may be easily followed. The propelling and controlling means may be adjusted so as to force the propeller forward and at the same time cause the same to move on



TORPEDO.

an even balance notwithstanding the pull of a wire connected therewith. An object is to provide a torpedo which is propelled by power from the shore and controlled by the amount of current supplied, thus allowing the torpedo to be steered from the shore and exploded at any time regardless of its speed and depth or direction of movement.

DEVICE FOR IGNITING FUSES.—J. H. REINEKE, Weitmar, near Bochum, Germany. By the present invention unintentional response of fuses is avoided by using alternating currents of high frequency for igniting the fuses and by connecting the fuses to the conductor in such a manner that continuous electric currents or alternating currents of ordinary frequency, which may enter the conductor, are not able to ignite the fuse, as this can only be effected with the assistance of a particular kind of current.

Of Interest to Farmers.

BEATER FOR THRESHERS.—F. KERIAN, R. D. No. 4, Grafton, N. D. The inventor provides a beater which is disposed above the grain pan and the straw rack, the beater being constructed with a drum having annular grooves in which are journaled rollers which engage and reciprocate pivoted beater sticks which are prevented from lateral movement by the sides of the annular grooves.

PNEUMATIC PACKER.—V. N. PERRY, 507 Ellicott St., Batavia, N. Y. This invention provides a fan for use in pneumatic stackers, so arranged that the straw may be delivered axially of the fan directly to the blades or vanes, wherein the central control of the fan is free and unobstructed to receive the straw, and wherein a double blade construction is provided, the two portions of the blade being arranged one behind the other, the front portion being the straw blade and the rear portion the air blade.

MILKING MACHINE.—A. TRUCHOT, Choteau, Mont. The improvement provides a device by means of which the milking of a cow may be accomplished rapidly and economically and with no danger of injuring the animal. The device is of light weight and adjustable so as to permit the movement of the animal during the milking operation.

DAIRY REGISTER.—R. L. LACHAPELLE, Altona, N. Y. This is a device for keeping daily, monthly, and yearly records, being arranged particularly for cows, for the milk yield, and the character of the yield, of each of a plurality of cows, and the main object thereof is to provide means for keeping such records in a cleanly manner, and wherein the record of each cow for at least fifteen days is visible day by day, the monthly record of each cow for the preceding year for comparison, the total record of each cow for the current month or less, the total yield of all the cows, and other matters of importance.

MARKER FOR CORN PLANTERS.—R. E. MUDD, Stronghurst, Ill. This invention provides a marker for corn planters, which can be easily and quickly attached to any make of corn planter, which is operable from the driver's seat, and which will mark on any kind of ground, rough or smooth, hilly or level.

Of General Interest.

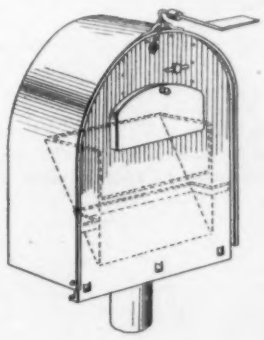
TOOTH BRUSH.—C. E. CARROLL, Newport, Ark. By arrangement of the tufts of bristles, the gums are massaged and their free margins are cleaned during the ordinary operation of brushing the teeth; also, by the arrangement of the angles of the tufts of bristles to each other and to the teeth, the roots of the latter and adjacent portions of the gums are thoroughly scrubbed.

PACKAGE TIE.—E. F. FORSGARD, 1122 N. 4th St., Waco, Tex. One of the principal objects here is to provide a tie with which the ends of a string that has been passed around a package may be securely held, without cutting or abrading the string, which would necessarily weaken the same.

STERILIZER.—D. W. BROOKS, Royston, Ga. The device is adapted for the simultaneous sterilization of a number of articles, such as drinking glasses for soda fountains, schools and other public places, wherein the articles are simultaneously washed or cleansed by boiling water, and wherein the articles are so arranged during cleansing that the contents may easily escape from the glass, and wherein the articles are thoroughly protected from breakage.

SEA ANCHOR AND OIL TANK.—L. KAHNWEILER and O. KAHNWEILER, care of Kahnweiler & Sons, 260 Front St., New York, N. Y. This invention refers to sea anchors and particularly to sea anchors provided with oil tanks, and has for an object to produce a construction of anchor co-acting with an oil tank secured to the anchor which is adapted to supply oil to the waves previous to their striking the anchor.

MAIL BOX.—C. F. UTTERBACK, Lock Box 201, Mooresville, Ind. This invention provides means manually operable for locking and unlocking the box, the lock mechanism being composed of a keyless and key lock combined, and having a middle or intermediate lock or latch. All keys are alike and are for use of the carrier only. The lower or combination



MAIL BOX.

lock is for use of owner of the box, the combination lock automatically unlocks the intermediate lock, thus making the use of the key very seldom, as the intermediate lock is for use of both parties and works on a plan like a safe. The box is provided with a target that is automatically raised when the door is open. The lock can be manufactured at a small cost.

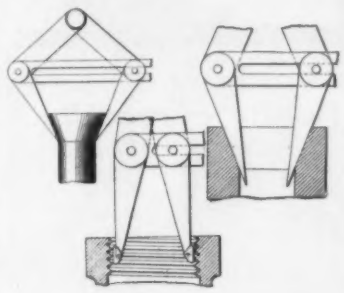
METHOD FOR LOCATING LIQUID STRATA IN A WELL.—T. A. BEECHER, Taft, Cal. The method has for its purpose the location of a liquid entering a well, and has reference more particularly to the location of water entering an oil or gas well, to which well water is very injurious, and therefore a water stratum must positively be shut off from the well to make an oil or gas well exploitable.

CULVERT FORM.—L. H. TOWNER. Address Benj. G. Wheeler, Surety Bld'g., Muskogee, Okla. This inventor provides a form consisting of sections that may be assembled to hold plastic material capable of hardening, as, for instance, concrete or the like in the proper shape, until the material has been hardened to a point where it will stand alone, and which then may be disassembled and removed to permit its reassembling at another point.

FOLDING TOOTH BRUSH.—L. KALINA, 384 Alabama Ave., Brooklyn, N. Y., N. Y. This invention provides a brush arranged to permit the user to conveniently extend the brush for use or to fold the same in a hollow handle with a view to take up very little room and to allow of packing the brush into a hand bag, vest pocket, valise or other receptacle without danger of the bristles coming in contact with other articles.

Hardware and Tools.

CALIPERS.—ANTONIO V. ESPINAL, Banes, Cuba. The invention relates to calipers and the object thereof is to provide such a tool which is adapted for use as a point compass, exterior and interior cone calipers, for determining angles of irregular articles or objects,



CALIPERS.

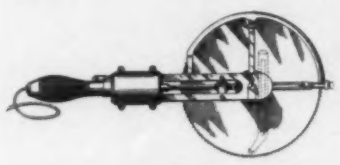
for determining the over-all diameters of exterior or interior screw-threads, and for a multiplicity of purposes, and which may also be folded into a very compact form, relatively as compact as a pocket-knife, for storing when not in use.

ADJUSTABLE BORING TOOL HOLDER.—W. C. MORRIS, 1052 Lehigh St., Easton, Pa. This invention relates to metal-working machinery and has particular reference to holders for boring tools. The invention provides a holder for a boring tool providing for delicate

ADJUSTABLE BORING TOOL HOLDER.

and accurate adjustments for various purposes, including the facilities for resetting a tool to the precise position in which it may have been set previously, and also to provide precise degrees of adjustment for the boring tool for jig work purposes.

PORTABLE CIRCULAR HANDSAW.—L. H. MARTIN, 136 W. 98th St., N. Y., N. Y. The invention provides a saw with mechanical means for operating the saw. An object is to so construct the parts that the saw, which is



PORTABLE CIRCULAR HANDSAW.

of the circular type, may be conveniently replaced as may be desired, either by a new saw or with a saw of a different size, or with teeth of any type to meet the conditions of use. (See advertisement on page 391.)

LEVEL.—T. COUGHLIN, 1208 Clay Ave., Bronx, N. Y., N. Y. This invention provides a level having a level member which is normally rotatably disposed to a circular opening in a frame, an annular flange being provided having orifices at recesses in a serrated disk and which register with threaded orifices in the level member, so that screws which are provided may be disposed in the orifices and in the recesses for holding the level member in adjusted position.

CORRUGATED IRON FASTENER.—M. A. MCCOY, Seaman St., Perth Amboy, N. J. This invention relates to devices for corrugated sheet metal, and an object is to provide a structure which may be quickly applied and removed. The invention provides a device in which a minimum number of parts are used without sacrificing any of the strength or retaining ability of the device.

AUTOMATIC SASH LOCK.—J. H. BARTON, Jones, Tenn. This invention relates to improvements in sash locks and more particularly to an improvement upon the structure illustrated in Mr. Barton's Patent No. 879,078, in that the device is automatic in its operation in engaging and holding the sashes against movement, that is, to prevent the upper sash from being lowered and the lower from being raised.

Heating and Lighting.

PIPE SUPPORT.—W. B. GRAY, 1327 S. 22nd St., Louisville, Ky. The present invention is an improvement in pipe supports, and has for its object to provide a device adapted to carry a certain character of pipe used in heating systems, or for other purposes wherein the pipe is subject to expansion and contraction.

AUTOMATIC DAMPER.—A. W. ARNOLD, 1345 Elmdale Ave., Chicago, Ill. This invention relates to automatic dampers of the type comprising one or more pivoted wings adapted to hang normally by gravity open in the path of the draft in a stove pipe or furnace flue and having means for varying the automatic closing operation of said wings according to the variations in draft in said pipe or flue, due either to outside wind influence or draft caused directly by variations in heat within the stove or furnace.

THERMOSTATIC MEANS FOR OPERATING HOT AIR REGISTERS.—A. P. BROOMELL, York, Pa. This invention relates to improvements in devices for operating the registers of hot air heating systems, and an object is to provide a simple device which may be used in connection with a hot air heating system which will automatically open and close the register gates.

AUTOMATIC HEAT CONTROLLING DEVICE.—A. P. BROOMELL, York, Pa. An object here is to provide a device in which a thermostatic member is directly connected with a radiator valve so as to control the valve in accordance with the temperature of the room. Another object is to provide a device with means for regulating the device so as to cause the valve to operate at any predetermined temperature.

Household Utilities.

EXTENSION TABLE.—D. F. OLIVER, care of Hotel Ponchartrain, Detroit, Mich. The purpose here is to provide a table having slidable end leaves, and extension leaves at the middle of the table, and adapted when not in use to be folded within the table rim, the arrangement permitting of readily moving the extension leaves into extended position flush with the end leaves.

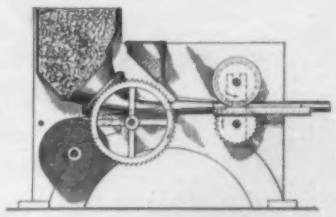
BEDSTEAD.—P. H. VOELKER and KARL KIMMICH, care of the latter, 1281 Putnam Ave., Brooklyn, N. Y., N. Y. Among the principal objects which the present invention has in view are: to provide a bed contractible lengthwise to accommodate variations in the rooms in which the bed is placed, and to provide for variations in the bed in correspondence with the service to which it is put.

DOOR HANGER.—S. J. WILLNER and G. FOLEEN. Address the former, 666 Irving St., Portland, Ore. The invention provides a hanger especially adapted for use with a series of doors or windows for hinging the doors and windows together and for connecting the said doors and windows to a track bar to permit the doors or windows to take a position in the same plane or in parallel planes.

Machines and Mechanical Devices.

VARIABLE SPEED GEARING.—J. W. CAMPBELL, P. O. Box 40, Reno, Nev. The object here is to provide a transmission gearing by means of which various speeds may be imparted to the driven shaft, and in which the change from one speed to another is accomplished by means of clutch members without the necessity of shifting gears out of or into mesh with certain other gears.

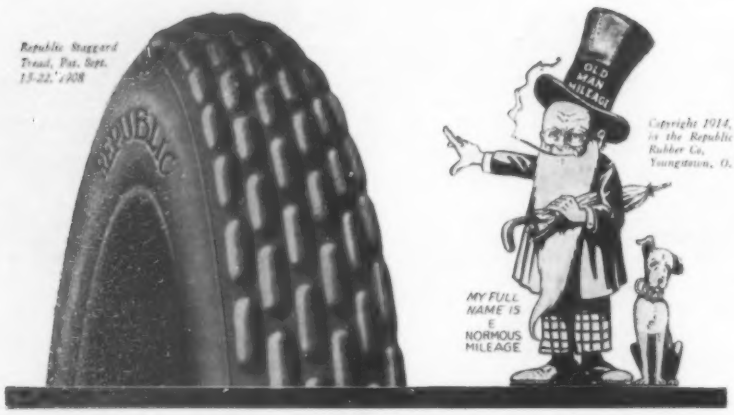
CIGARETTE MACHINE.—H. C. GALLUP, 291 Broadway, New York, N. Y. This inventor provides a structure for the making of cigarettes from a continuous strip rolled to provide a wrapper and continuously filled with tobacco or the like, while the longitudinal edges of the strip are united so that the cigarettes may be



CIGARETTE MACHINE.

cut off from the proper lengths as the filled wrapper is fed from the machine. He also provides means for providing for feeding the tobacco to a filler tube for subsequently discharging the tobacco into a wrapper which is closed and fed in a novel way from the machine.

INTERMITTENT TRANSMISSION MECHANISM.—C. CAMPUS, care of Siro Co., 33 35th St., Brooklyn, N. Y., N. Y. The patent covers a new mechanical movement to convert a reciprocating into rotary motion, and is designed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for different machines in which it is required to lock a driven rotary element at predetermined times. A reciprocating member has a spring pressed transverse pawl to engage teeth on the driven element and actuate the latter step by step. The device includes means whereby the driven element is locked against retrograde movement, or accidental forward movement, between the regular forward impulses.

ICE BREAKING MACHINE.—A. G. KROCKER, Waco, Tex. The invention relates to ice breaking machines, and one of the principal objects is to provide a machine whereby cakes of ice may be broken up into pieces of the desired dimensions, in a quick and accurate manner and with a minimum amount of waste.

BUTTON ATTACHING MACHINE.—B. KOTKOVSKY, 172 Lorimer St., Brooklyn, N. Y., N. Y. In the present patent the invention has reference to button attaching machines of that type which includes a mechanism for mating, driving, and clenching the staples whereby the buttons are attached to shoes, gaiters, leggings, and other articles. The machine is so designed as to be adapted for use with buttons of different sizes.

APPARATUS FOR DRYING MATRICES USED FOR STEREOTYPE PURPOSES.—C. WINKLER, Berne, Switzerland. This invention provides a device for automatically arresting the drum in a suitable position for taking out the matrices. The apparatus is, further, so constructed that, by closing or opening the door of the drum, the driving mechanism for the drum is simultaneously put in or out of operation. Means provide that on opening the door the cock is closed somewhat, while on closing the door it is opened.

ADJUSTABLE TABLE FOR WIRE CLOTH RACKS.—W. G. NEWMAN, 660 S. Main St., Salt Lake City, Utah. An object here is to provide a table which may be elevated or lowered and which may be locked in its shifted positions so as to form a cutting table and a measuring table for rolls of wire cloth screen which may be situated at different heights or at different portions of the rack.

AUTOMATIC GASOLINE SERVICE.—S. F. MIOTOS, 2523 Esplanade Ave., New Orleans, La. While the device is adapted for dispensing varieties of liquids, the object primarily is to provide a means adaptable for supplying gasoline or the like for automobile use, at any time of day or night, and without requiring the presence of the owner or attendant to assist in such delivery.

ROLL MILL FOR HARD MATERIALS.—H. ALDEHOFF, Berlin, Germany. In this new mill an output of 3,500 kilograms of finished cement is obtained when only 10,000 kilograms of raw material are passed through the machine. This increase over existing mills is double and is explained by the fact that the rolls and grinding ring are kept free from fine material, so that the material which is still coarse is not subjected to the grinding action in a bed of fine material. A further advantage is that the transport apparatus has less material to deal with, so that less power is required.

Prime Movers and Their Accessories.

ROTARY STEAM ENGINE.—E. V. MACK, 327 E. Palmetto St., Florence, S. C. This invention provides a rotary steam engine which is very compact, perfectly balanced, composed but of few parts, not liable to get out of order, and arranged to run at a high rate of speed and to utilize motive agent to the fullest advantage.

Railways and Their Accessories.

MAIL BAG RECEIVING AND DELIVERING MECHANISM.—B. F. NICOLL, 4439 South Liberty St., New Orleans, La. The primary object here is not only to facilitate the delivery of mail with speed and dispatch to and from trains at a high rate of speed past stations where no stop is scheduled, and posts and other points along the route, but to increase the efficiency and capacity of such devices, whereby large quantities of mail may be handled according to governmental requirements with the idea of producing a standard device.

RAIL JOINT.—G. H. MARTIN, 108½ West 2nd St., Oklahoma, Okla. One of the principal objects of the invention is to provide a joint so constructed as to securely maintain the rail ends in position, without the use of bolts and nuts, which, as is well known, have a tendency to become loosened by the vibration given the joints upon passage of rolling stock therefrom.

CAR WINDOW CLEANER.—A. JOHNSON, 2384 First Ave., Manhattan, New York, N. Y. The purpose here is to provide a simple, strong, and efficient window cleaner which can be easily and quickly attached to or removed from a window frame and whereby the outer surface of the window can be wiped from within without disturbing the window frame.

BRAKE SHOE.—J. E. WORSWICK, 215 N. Lawrence St., Montgomery, Ala. The shoe is for use with car wheels of every kind, and especially for use with chilled cast iron wheels, wherein the elements constituting the shoe are so arranged that when the shoe is in contact with the wheel, a maximum of braking efficiency will result with a minimum of heat evolution, and wherein the shoe will dress the periphery of the wheel at every point except where the wheel is engaged by the rail.

Pertaining to Recreation.

CHAIR SIGNAL FOR THEATERS.—J. J. MCCOMISH, 36 W. 128th St., New York, N. Y. The purpose here is to provide a method whereby the unoccupied chairs in a theater or darkened hall may be quickly and easily located by the attendants, or by persons looking for seats. The invention provides a means for determining when two such unoccupied chairs are adjacent to each other, in the same row of chairs.

Pertaining to Vehicles.

PNEUMATIC TIRE FOR ROAD VEHICLES.—E. R. DEVEREUX, 2-4 Avenue Chambers, Southampton Row, London, W.C., England. This invention is designed to provide a tire in which the abutting ends of the segments are strengthened so as to resist the tendency of such segments to burst when in use. In combination with the segmental inner tube of the invention, the inventor provides a laced-on cover which allows of any punctured segments being removed and repaired.

DUMPING WAGON.—J. J. MCGUIRE, 48 W. 142nd St., New York, N. Y. The improvement has for an object to provide a structure which may be readily dumped and again readily restored to its original position. It also provides in a dumping wagon means for automatically removing the end or tail-board as the wagon is dumped.

CHAIN TOOL.—E. P. MCGUIRE, Van Houten, New Mex. By means of this tool the non-skid or mud chains used on automobile wheels may be tightened. The invention provides a tool including a double rack bar having a hook at one end to engage one end of the chain, and a lever provided with pawls for co-operating with the rack bar, the lever carrying a hook for engaging the opposite end of the chain.

ASH CART AND CAN.—H. KASTOR, 125 E. 23rd St., New York, N. Y. The inventor provides a contrivance which will automatically bring into register the top of the can and the opening in the cart by uncovering the cart and can during the up-turning movement of the can to deliver the contents into the cart, and which will restore the covers to their original positions when the can is turned to its normal position.

DEMOUNTABLE RIM TOOL.—M. M. HERMAN, 301 Hennan Bldg., Danville, Va. The invention refers to tools for use in connection with demountable rims for motor vehicles and the like, and more particularly to a tool attached to, and detachable from, a rim to provide for its detachment from a tire disposed thereon, irrespective of the manner and means by which the rim is or may be demountably secured upon the wheel.

Designs.

DESIGN FOR A BADGE OR SIMILAR ORNAMENT.—M. C. BARNARD, 36 Perkins St., Winthrop, Mass. In this ornamental design the badge is represented by four large sized T's crossing one another, in the center of which is a circle holding the legend LUCKY SEVEN. Between these words is a space marked by seven up and down depressions.

DESIGN FOR A WOVEN AND PRINTED RIBBON.—R. JACOB and E. SPECK, care of Johnson, Cowdin & Co., 126 Fifth Ave., New York, N. Y. The ornamental design in this case represents a ribbon on which are bunched the characteristic flowers of the States of the United States of America.

DESIGN FOR A RADIATOR HOOD.—D. MC RA LIVINGSTON, 159 E. 36th St., New York, N. Y. In this ornamental design for a radiator hood there are three views. The first is a front presentation; the second a side elevation; and the third a rear perspective view. The design is highly original, graceful, and attractive.

DESIGN FOR A GLASS VESSEL OR SIMILAR ARTICLE.—T. B. CAMPBELL, care of T. B. Campbell Co., 40 South 8th St., Brooklyn, N. Y., N. Y. This is an ornamental design for a cut glass vessel.

DESIGN FOR A NECKTIE.—A. BENNETT, 123 Prince St., New York, N. Y. In this ornamental design for a necktie, the tie consists of a round tufted cord ending in a tassel.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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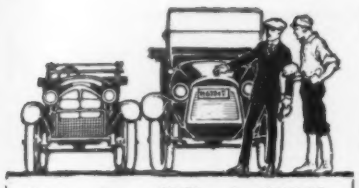

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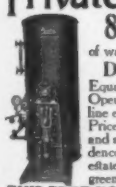

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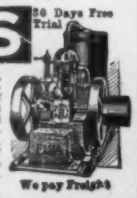

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Illumination of the Panama-Pacific International Exposition

(*Concluded from page 378.*)

proceeding from a giant battery consisting of forty-eight searchlight projectors, each with a 36-inch lens. These fling an aurora of colored lights into the heavens. The battery, manned by a trained crew of operators and handled with the precision with which a gun crew is operated, has behind it a force of 2,000,000,000 candlepower.

In addition to these four principal sources of lighting, there are several minor sources. In various parts of the grounds are globes of white glass, the light from which, at night, dissipates the shadows beneath the palms and other foliage upon the exposition grounds.

In the great central Court of the Universe a similar principle is employed. In this court two lofty columns of dense white glass are parts of the sculptured Fountains of the Rising Sun and of the Setting Sun. These fountains are a principal source of the night illumination of the Court of the Universe and give forth a soft white light which penetrates to the farthest recesses of the court.

The globes of light and also the columns in the Court of the Universe are in harmony with the principal purpose in the illumination of the exposition to employ no direct lighting. In all instances except the last two mentioned the light is concealed, and in these last two it is diffused through the heavy glass.

The maneuvers of the batteries of searchlights and the interior illumination of the Palace of Horticulture leave nothing to be desired in the way of spectacular or pyrotechnic effects, while the illumination of the exposition as a whole presents every advance developed in the lighting of municipalities. The lighting of the exposition was planned and executed by Mr. W. D'A. Ryan, consulting engineer of the General Electric Company.

Animal Life in a Zoo

(*Concluded from page 385.*)

in the woods, becomes their best friend, and they will frequently come at his call to receive his caress. We don't hear the "friends of animals" protesting against the treatment of the farmer's cow. True, she is a necessity, but she does not know that, and the fact does not make her any more willing to have her head confined between two poles all night, so that she cannot turn around, nor any more contented to have her calf sent to the slaughter house when she was just beginning to enjoy the pleasures of motherhood. I have seen more agony expressed by a cow when her calf was taken away from her than I have ever seen by any animal in any zoo. Mr. Bull tells of an otter in British Guiana, larger than our kind, that found a gallinule's nest and bit the heads off all the young ones. He didn't eat them, he wasn't hungry, he just did it in the spirit of play and as a working out of a primal instinct. He then took one of the little fluffy bodies and played with it as a cat plays with a ball of worsted. He took it into the water and threw it up in the air, dove under it and came up with it on his back, dove again and appeared with it on his neck. I have watched an otter in the Washington Zoo go through a similar performance, only in the place of the young bird he used a flat stone. He would throw the stone into the pond in his inclosure, dive, and come up with the stone on his forehead. After exhibiting his skill to the many visitors who were watching him, he threw the stone into the water again, and, just to show it was not accidental, he repeated the performance. He was evidently having a very good time, just as good as his distant relative in the jungle, and he did not deprive any mother bird of her nestling.

There is one class of animals that doubtless is more unhappy in its confinement than in the wild state, and that is the large cats, the lions, tigers, etc. They don't have many animals to fear, but all the smaller and weaker animals fear them. Each lion takes a yearly toll of from fifty to one hundred harmless, beautiful ani-

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mals, and, of course, in a zoo he is prevented from carrying on his wholesale slaughter, and he doesn't like it. It irritates him and makes him unhappy. But why show so much sympathy for this brutal murderer, why not extend your sympathy to the scores of perfectly harmless animals whose lives are spared by this one lion's confinement. "But," says the "friend of animals," "the lion is only obeying the laws of nature." Very true, the cat is obeying the laws of nature when she eats a canary whose cage has carelessly been left within her reach. The canary, by the way, in its pretty brass cage, is more of a prisoner and more confined than any bird in any zoo that I have ever visited, yet the owners of these pets have a kindly feeling toward animals and do not realize the cruelty of keeping their little birds in such narrow quarters where they can never spread their wings in flight or mingle with their own species, both of which privileges they would enjoy in a well equipped zoo. Nearly, if not all, the laws passed in this country for the preservation of wild birds, have been suggested and advocated by sportsmen, real sportsmen, not pot hunters and plume hunters; while the cruelest slaughter of wild birds, the traffic in aigrets torn from the backs of the snowy egrets while rearing their young, thereby killing the young as well as the old birds, is patronized and made possible by women only. Surely while women demand these ornaments the egret in a zoo is far better off than those in the southern swamps within range of the plume hunters. The late Arthur E. Brown, director of the Philadelphia Zoo, was a most kind-hearted man, and a true friend of animals. He told many amusing suggestions he had from kind-hearted people, meant to improve the conditions of the birds and animals in his care. A lady who was a constant visitor at the zoo, and also a liberal contributor toward its maintenance, told him she thought the hawks suffered at certain times of the day from the sun, and asked him if he would have an awning put in the cage at her expense. He thought it unnecessary, but promised to have it done. One day soon after it was installed, and while the sun was at its height, the lady called to see the result of her experiment, and found the hawks all sitting in the sun, *on top* of the awning.

Many instances could be told of wild animals that have been kept in captivity being offered their freedom, and refusing to avail themselves of it, preferring the civilized life.

Remember that everything in the jungle is in danger, "everywhere stalks the grim specter." In the zoo not an inmate of any kind has a single enemy to fear, and everything possible is done for their comfort. To you a zoo may seem a prison, to others it is more of an asylum, and the loss of absolute liberty is compensated for in most cases by all absence of fear and danger.

An Electrically Operated Loader

(*Concluded from page 386.*)

large lump coal. The 24-inch steel apron loader is similar in general design to the belt machine, but is heavier throughout and is provided with a 15 horse-power motor. The apron conveyor consists of beaded plates carried on roller chains of standard make, the apron on the return side running on angles projecting beneath its edges. Similar angles project beneath the upper edges to prevent spillage, but do not take any of the weight of the apron.

In order to prevent spillage of coal on the apron an angle is riveted to every fifth plate, thus assuring a positive discharge. Guides carry the roller chains directly to the pitch line of the sprockets and prevent all hammering. They are bolted in and can be quickly and easily replaced when worn out. This machine is tilted by power and the arms are provided with a lock which keeps the loader in position either when loading or when out of the car. A screw jack with ball thrust bearing makes it possible for one man quickly to raise or lower the loader as conditions require.

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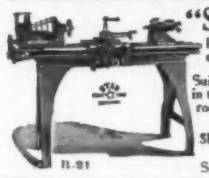

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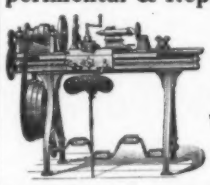

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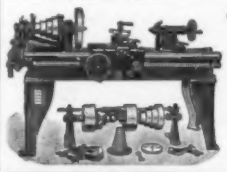

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the rate of four tons of coal per minute, the 24-inch machine will load six tons per minute, and the 24-inch steel apron loader eight tons per minute. As two minutes are required to get the loader in and out of the car, to attach and detach the chute and to change from one end of the car to the other, the time required to load is two minutes, plus the actual time the coal is running, determined from the above rates and size of car. This, plus the average time to spot the cars divided into sixty, gives the actual rate of loading in cars per hour.

Continuous Aviation Competitions

MOST elaborate plans have been made by the Aero Club of America, in co-operation with its affiliated clubs, some twenty-five in number, for a series of daily competitions continuing from July 4th. This competition is to be for the greatest distance covered in ten hours during the ninety days, and those making the best records will be awarded prizes, including a special daily prize of $100. Flights may be made from any of the official aerodromes, to be designated in various parts of the United States, and any or all of the aviators may start each day.

These competitions are designed to assist the Army and Navy Departments in developing aviation corps for the National Guard and Naval Militia, to demonstrate for the Post Office Department the practicability of carrying mail by aeroplane to the hundreds of isolated places where it now takes days to deliver mail which could be delivered by aeroplane in a few hours, and to develop the sport in general.

The competitions are on the same plan as those for the Pommery Cup, in France, which resulted in great benefit to the sport in that country, and developed many remarkable performances.

Nine prominent aviators and constructers have already made known their intention to enter these contests, and it is gratifying to the committee that all the entrants so far propose to use American made aeroplanes and motors; and it is an encouraging indication of the interest aroused, and the progress made since our Government has shown an indication of its intention to increase the use of aeroplanes in the Army and Navy.

It is expected that among the contestants will be Lawrence B. Sperry, with two machines, one a regular land aeroplane and the other a flying boat, both equipped with gyroscopic stabilizers.

The Current Supplement

THERE has been considerable discussion from time to time on the effect of electricity on plant growth, as applied to agriculture, and some experimental work has been done. A *résumé* of the literature on this subject, with notes on the experiments, is given in the current SUPPLEMENT of the SCIENTIFIC AMERICAN, No. 2051, for April 24th, 1915, which will be of value to those interested either in electricity or agriculture. There are plenty of excellent automobiles on the market that have been used a short time and are still as good as new, and many people would be glad to buy them if they knew how to select a good car. An article by an expert tells the tricks of the second-hand trade and describes the points to be looked to when buying a used car, and there is a full-page drawing that illustrates the points raised. The Treasures of Lahun tells about the discovery of some remarkable jewelry, ornaments, and tools found in an Egyptian pyramid, which had escaped plunderers for many ages. There is an interesting summary of the method used in determining the Washington-Paris longitude by radio signals; also an article of interest to surveyors that tells how to make hour angle observations of Polaris by daylight. The story of the Roosevelt-Rondon scientific expedition in South America is concluded; as is also the valuable article on the Wireless Transmission of Energy, an article as interesting to the layman as to the scientist. How Narcotics Affect Plants is a brief summary of a paper by a foreign authority.

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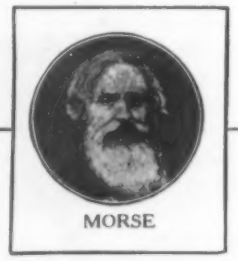
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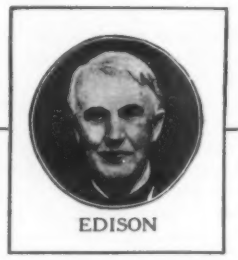
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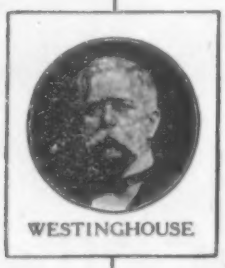
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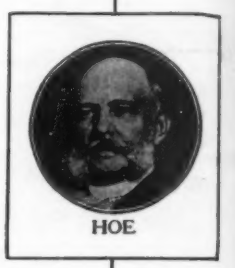
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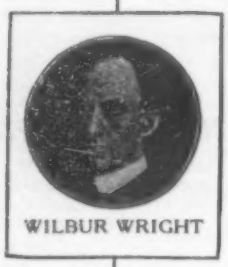
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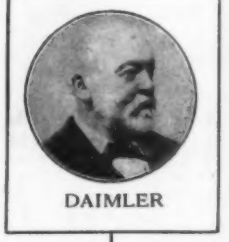
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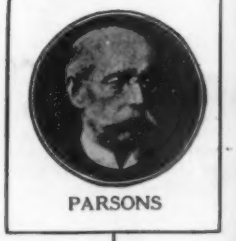
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Number of the

Scientific American

June 5th, 1915

THE Scientific American was founded seventy years ago, at a time when the United States of America was industrially less developed than South Africa at the present time. Even territorially, it was not the same country we know now; for California, Texas, and the great Southwest belonged to Mexico.

During that long period of seventy years the Scientific American faithfully chronicled the technical and industrial progress which we Americans made. Its editors saw the advent of the reaper, the telegraph, the telephone, the great trans-continental railways, the laying of the transatlantic cable, the development of the giant steamship, the perfection of the phonograph, the glow of the first electric incandescent lamp, the coming of the motion picture machine, the miracles wrought by wireless telegraphy, and more recently the conquest of the air.

What an age of wonders it has been! What a transformation has been wrought upon the face of the earth! Surely no tale of the Arabian Nights, no fantasy of Jules Verne depicts marvels so amazing as those which the Scientific American has been the first to describe authoritatively as soon as they appeared. Who would have thought, seventy years ago, that with the aid of the X-rays we could look through a man's body; that friend could talk with friend from New York to San Francisco; that Niagara Falls would illuminate cities; that street cars would move magically through our towns without any apparent means of propulsion; that pictures would be sent by wire from New York to Chicago, and that by means of the boundless ether a solitary passenger ship on a desolate ocean still keeps in touch with civilization.

It has been the privilege of the Editors of the Scientific American to know the men whose master minds have wrought these things, and to hear from their own lips the story of their struggles and their triumphs. Ericsson, Morse, Edison—the whole dynasty of inventive genius which has made the nation what it is—the editors have known them all.

Seventy years is a turning point not only in the life of a man, but in the life of any enterprise. It seems fitting that the occasion should be commemorated by the publication of a number which will review the progress that the United States of America has made in the three-score years and ten of our existence.

In June a number will appear which the Editors hope will do full justice to the great theme of American invention —a number which will transport us all back to the time when our fathers and our grandfathers still burned candles, when horses pulled street cars, when there were no automobiles and when the steam railway was a curiosity that people would travel miles to see. The motion picture machine of industrial progress will be turned backward, and the flickering film will make you wonder what the future will have in store if so much that is wonderful has happened in the past.

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